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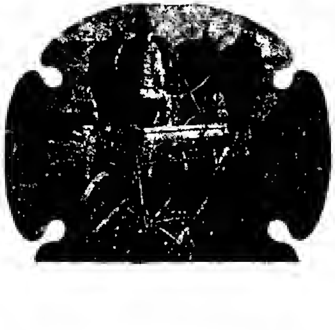


THE JOURNAL

OF

The Department of Agriculture

OF

VICTORIA.

Vol. XV. Part 1. 10th January, 1917.

WHEAT EXPERIMENTS.

FIELD DAY AT LONGERENONG AGRICULTURAL COLLEGE.

Magnificent Field Crops.

(Abridged from the "Horsham Times.")

There was a good gathering at the Longerenong Agricultural College on Saturday, 25th November, when the annual field day was held. A severe thunder storm, accompanied by heavy rain, passed over Horsham on Friday night, and the roads were consequently very heavy in condition. Despite the threatening weather and the almost impassable roads, upwards of sixty farmers and visitors assembled at the entrance to the field plots, where they were welcomed by Mr. A. C. Drevermann, principal of the college. The vice-president of the Horsham Agricultural Society introduced Mr. A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent of the Department of Agriculture, who took the gathering in hand, and conducted them over the field plots.

Mr Richardson, in an introductory address, congratulated the farmers on the bright prospect for the approaching harvest. The Wimmera had probably never looked as well as it did at the present time. They had had seasons in which the rainfall was as heavy and as well distributed as the present year, but the crops would probably yield a higher average than ever before. That was due to the progressively improved methods of cultivation characteristic of the Wimmera. The farmers were alive to the necessity of putting their best work into the cultivation of their wheat crops. The raw materials of the farmers' business were rising rapidly in price. Implements, bags, twine, oils, duplicates, and labour had increased considerably in price during the past three years. The farmer could only meet these increased charges by making his holding more efficient. That he could do, not by growing more acres of wheat, but by growing bigger crops of wheat per acre. The cost of working a

15-bushel crop was not much less than working a 30-bushel crop. The net profit in the latter case, however, was four or five times as great. The factors necessary for success in the cultivation of wheat were well known. Bare fallowing, thorough working of the soil, preparation for a good seed bed, the liberal use of superphosphates, systematic rotation of crops, and care and attention to the preparation and selection of the seed, were the prime factors. Attention to these principles would guarantee a heavy crop. Some men regularly secured double the yield of their neighbours and the average of the district. On analysis, it was always found that these successful men had a clear vision of the above principles, and were able to translate the principles into practice. Sheep were becoming more and more necessary for the successful working of wheat farms. The one-crop system of farming had many drawbacks, but the association of sheep with wheat would assist in counteracting these. The markets for lambs and wool were absolutely assured, and it

Group of Members of Horsham Agricultural Society inspecting experimental plots. Longerenong Agricultural College.

was to the interest of every farmer to keep as many sheep as possible. Under the present system, in the Wimmera the numbers that could be kept on a farm were strictly limited, but the greatly enhanced price of lambs and wool during the past two years raised the question as to whether it would not pay the farmer to begin the systematic cultivation of forage crops for feeding down with sheep. The Department of Agriculture intended to test this matter, and had arranged with the Longerenong College authorities to lay down a series of permanent crop rotation tests next autumn.

The experimental work comprised manurial tests, variety wheat, barley, oats, and seed selection tests, forage plots, trials of crossbred wheats, and rate of seeding and time of sowing plots. The experimental plots as a whole formed a most impressive sight. Each plot was separately labelled with neat plates showing the name of the variety and details as regards the quantity of manure, &c. The growth of the wheat and

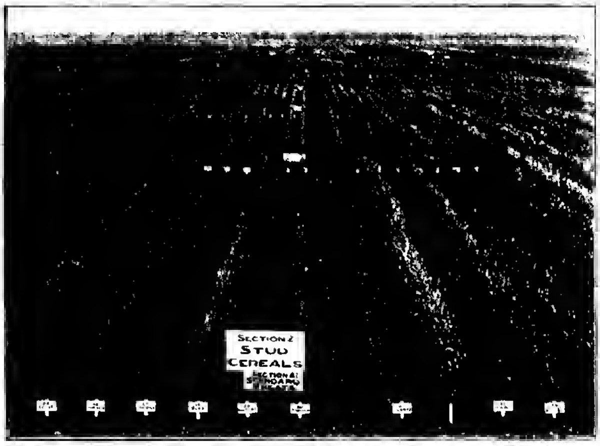
other cereals could hardly be excelled, and was eloquent testimony of the thoroughness displayed in the preparation and treatment of the soil. The manurial tests were the first to be inspected. Here fifteen different combinations of manures were being tested side by side. All the plots had made phenomenal growth. Mr. Richardson explained that the results of the last four years' tests had shown that the most profitable of all the manures that had been applied was superphosphate applied at the rate of 1 cwt. per acre. This was true both of wheat and dry seasons. The average amount used in the district when these experiments started four years ago was 56 to 60 lbs. He was pleased to see that last year and this year a number of the farmers in the district had been increasing the allowance of super. to the wheat crop. The amount of manure used in the Horsham district was steadily increasing, and the results of the Longerenong experimental plots showed that the application of larger dressings had given substantial and profitable increases over the lighter applications. One cwt. of super. had been used over the whole crop at Longerenong for the first time this year, and the college crops never looked better than they did this season. If the results of the work at Longerenong had only led farmers in the district to apply heavier dressings, the cost and labour involved in keeping up the plots would be more than justified. Bonedust and basic slag had not hitherto been found profitable at Longerenong. The plot dressed with farmyard manure looked remarkably healthy, so also did the plot dressed with nitrate of soda and superphosphate.

From the comments made by the farmers it is evident that the results of this year's experiment will be keenly watched, as some high yields are anticipated. Some of those present considered that the plot dressed with 2 cwt. of super. would give the highest yield, others favoured the plot treated with super. 1 cwt. and nitrate of soda. . Others, again, considered the farmyard manure would do best.

Mr. Richardson took the opportunity to explain that the differences of opinion among the farmers as to the probable yields of the fifteen manurial plots only showed how necessary it was to conduct the tests. Very few men could tell by inspection the difference between, say, a 12-bag and a 13-bag crop. The harvester, however, was an unerring judge, and would give to a lb. the difference in the yields. Unless a man could plainly observe the differences in yield between two crops he was apt to conclude that there was no difference at all. The visitors then passed on to the stud cereal section. Here were to be seen wheats, oats, barleys, and peas from all parts of the world, all sown neatly in rows, and labelled. Here were to be seen the short, stiff strawed Indian varieties, one of which was the grandfather of Farrer's famous Federation wheat. Here also were gathered the Fife wheats of Canada, the Durums from America, bearded types from the Argentine, and spreading types from the Steppes of Russia, together with a complete collection of Australian wheats. To the layman the endless varieties seemed bewildering. Mr. Richardson explained that the Department of Agriculture had scoured the world for new types of wheat, and had hoped that among the many varieties forwarded by the Agricultural Departments of other countries some would prove suitable for local requirements. It seemed, however, that some of these wheats possessed individually some remarkable qualities, *e.g.*, rust resistance, stooling capacity, drought resistance, and milling qualities, but they did not adapt themselves to local

conditions. Hence, they were attempting to produce by cross-breeding new types which would combine in one variety the desirable qualities required. A number of these new crossbreds were being tested in competition with the best local varieties, and judging by the results a considerable measure of success has been obtained. Three new crossbred varieties growing in the selection plots attracted special attention. These were Indian F x Federation, Clubhead x Yandilla King, and Indian H x Comeback.

The selection plots comprised fifteen varieties, grown from specially selected heads obtained by repeated selection. It was explained that the prolificacy of a given variety could not be maintained over a period of years unless systematic selection of the seed was practised. Considerable interest was manifested in the forage plots. Plots of Egyptian and Dun peas had done remarkably well, and were heavily podded. Both

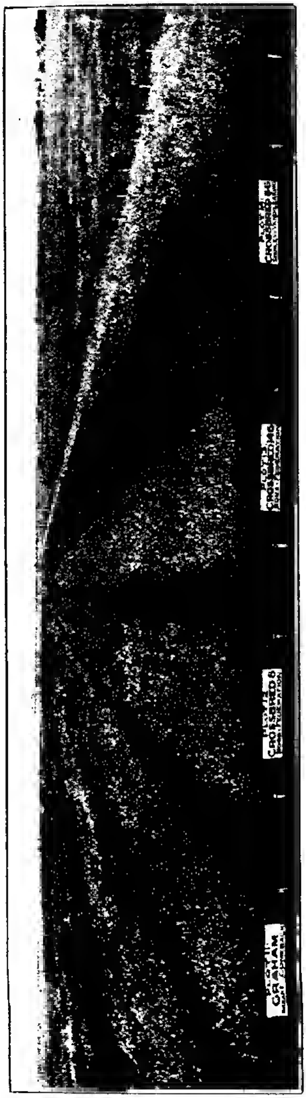


View of Stud Cereal Section. Experimental plots. Longerenong Agricultural College.

rape and rye and vetches did remarkably well. These were very useful crops to use in a rotation with wheat, especially where sheep were kept. The barley plots had suffered considerably with the winds. Cape, Oregon, and Short-head barley had made phenomenal growth, but portions of each had lodged with the heavy winds. Of the malting barleys, Prior was the earliest of all, whilst Kinver, Goldthorpe, Gisborne, and Archer were quite green; the Prior was approaching maturity, and looked a heavy yielder.

Mr. Richardson stated that barley was one of the most useful of crops in Victoria, and in the future would play a larger part in our agriculture than it had hitherto done. It was one of the best crops to grow for green feed, either for milking cows or for sheep. It could be sown late in the season, and would mature before wheat. It could stand drought, and had a lower water requirement than either wheat or oats.

It made excellent silage, especially if mixed with a few peas or vetches. Over 100 tons of silage had this year been gathered from 10 acres of college land sown to barley and peas.



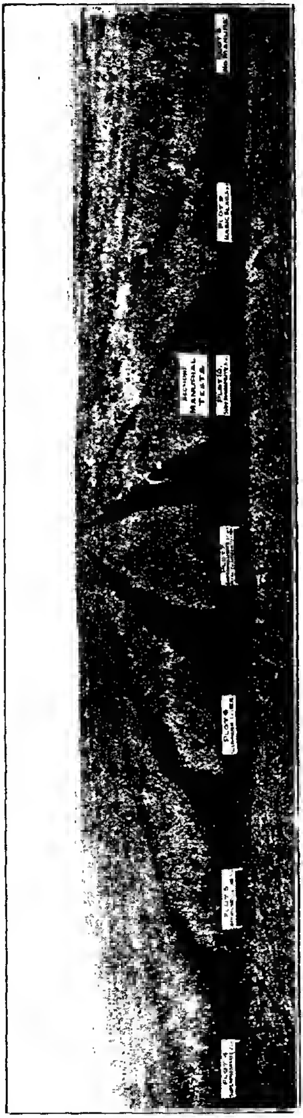
New Crossbred Wheats undergoing Field Trials at Longerenong.

The silage could be made before hay cutting was commenced. Again, barley made excellent hay if cut at the right stage. To get the best results for hay, it must be cut before any grain is formed. If left until the grain was formed, the hay became indigestible, and would be wasted by stock. If properly cured, however, it was eaten readily by all classes of stock. In California, barley hay was largely used for feeding all kinds of stock. Mr. Jacob, a successful dairyman at Mildura, regularly used barley hay for his milking herd.

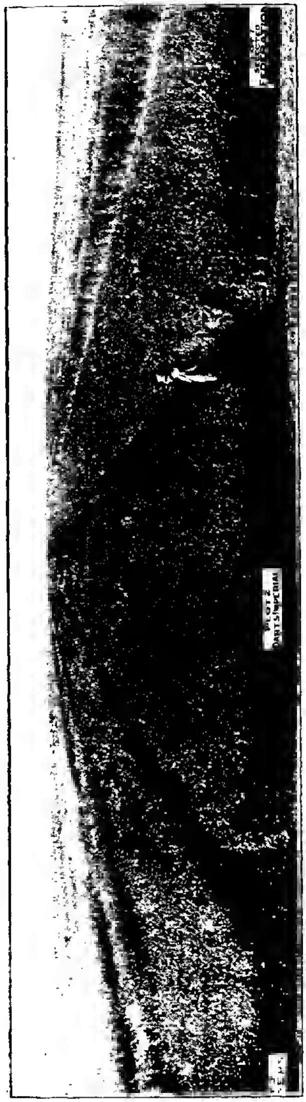
Finally, barley might always be relied on to give more grain per acre than wheat. Over 80 bushels of barley per acre have been obtained from the experimental plots at Longerenong.

The Wimmera would not produce an ideal malting barley except in favorable seasons. So long as stock were at their present price, however, there was a fine opportunity for the profitable utilization of crops of Oregon and Cape barley, either for green feed, ensilage, hay, or for grain.

The rate of sowing and time of seeding trials awakened considerable interest. In the time of sowing plots, six different varieties of wheat were sown on 13th May—before the rain—and the same were sown late, 13th July. Two early (Bunyip and King's Early), two midseason (Federation and Dart's Imperial), and two late varieties (Yandilla King and



View of Permanent Fertilizer Plots. Longerenong Agricultural College.



Variety Wheat Trials. Longerenong Agricultural College.

Marshall's No. 3), were sown on each of the above dates. The result was most instructive. The early sown Yandilla King and Marshall's No. 3 appeared to have done best of the early sown plots. Neither of the early maturing wheats, King's Early and Bunyip, were showing to advantage, though the late sown plots were much better than the early sown plots, showing that late sowing is better for quick maturing varieties than early sowing. On the other hand, the late maturing varieties, sown late, were just coming into head, and unless the weather conditions are extremely favorable from now on, they will suffer in yield.

The last section inspected was the Variety Wheat Plots, each half an acre in area. Prominent among these were Selected Federation, College, Eclipse, Graham (a new crossbred variety), Currawa, Major, Warden, Yandilla King, Hudson's Purple Straw, and Bunyip.

The gathering then adjourned to the large dining hall of the College, where afternoon tea was served. After partaking of refreshments, Mr. Knight (Mayor of Horsham), proposed a vote of thanks to Mr. Richardson for the interesting series of demonstrations he had given during the afternoon. These annual gatherings were increasing in popularity, and had it not been for almost impassable roads, he was certain that there would have been a record gathering at their annual 1916 visiting day.

The Seed Selection competition inaugurated by the Horsham Agricultural Society would commence this year, and he hoped that there would be a good competition.

Mr. Richardson, in responding, stated that the Agricultural Department intended to extend the scope of the Experimental plots at Longerenong by including a permanent rotation field, similar to those at Werribee and Rutherglen. In this way, the merits of some ten different systems of crop rotation, more or less applicable to the district, would be tested.

A vote of thanks was passed to the Principal and Staff, to which Mr. Drevermann suitably responded.

Under the guidance of the Principal, Mr. Drevermann, and Mr. Munro, farm manager, an inspection was made of the buildings, implements, and stock. The stables, cow shed, silos, and wool shed were inspected with interest, and favorable comment passed on the practical character of the buildings.

Over 600 lambs had been sold this year at 23s. 4d. per head. Wool fetched up to 1s. 7½d. per lb. The pigs aroused considerable attention. Two breeds—Berkshire and Yorkshire—are kept, and the young pigs find a ready sale in the district.

The new silos were filled from the produce of 10 acres of barley and peas. Whilst the dairy herd was being inspected an unrehearsed incident caused much amusement, though the makings of a grim tragedy were near at hand. One of the farmers, in his anxiety to inspect a specimen of a new dairy breed, got into a large yard with a Red Dane bull. The bull objected to such close inspection, and rushed wildly at the intruder. The farmer, though hoary with age, was suddenly infused with the energy of youth, and made one long leap for life. He reached the safe side of the fence amid the plaudits of the multitude, none the worse for his experience, but filled with profound respect for the male specimens of the new dairy breed.

WYUNA STATE FARM.

Experimental Work.

NEW VARIETIES OF WHEAT.

IMPROVEMENT OF STOCK.

(Abridged from the Kyabram "Free Press.")

A very interesting and profitable day may be spent inspecting the numerous experimental plots at the Wyuna State Farm. The bulk of the 1916 plots front the Shepparton-Echuca main road. The attention of the traveller along this highway cannot fail to be arrested by the unusual sight of a series of sixty plots, the treatment of which is indicated by large white labels suspended from the fences. At this time of the year the wheats are approaching maturity, and the colour and characteristics of each variety make themselves apparent. The effect is most pleasing, plots of red, bronze, and white chaffed wheats, bearded and bald, erect and drooping, tall and dwarf types succeeding one another in apparently endless array.

Apart, however, from the æsthetic side of the picture, it is obvious even to the layman that the practical value of such trials must be considerable, for here are gathered together for trial under Goulburn Valley conditions the best yielding varieties of wheat grown in the State, and some of the new crossbred wheats produced by the Department at the various State farms.

In addition to these variety trials, there are numerous Permanent Fertilizer tests, Rate of Seeding, and Time of Sowing, and Seed Selection tests, all of which are designed to throw light on practical problems affecting the everyday practice of the farmer No wonder that each Sunday groups of interested farmers from the surrounding districts may be seen threading their way through the plots, observing the behaviour of the numerous varieties, and watching the results of the cultural and fertilizer tests. Such a sight may be witnessed on any Sunday as harvest approaches.

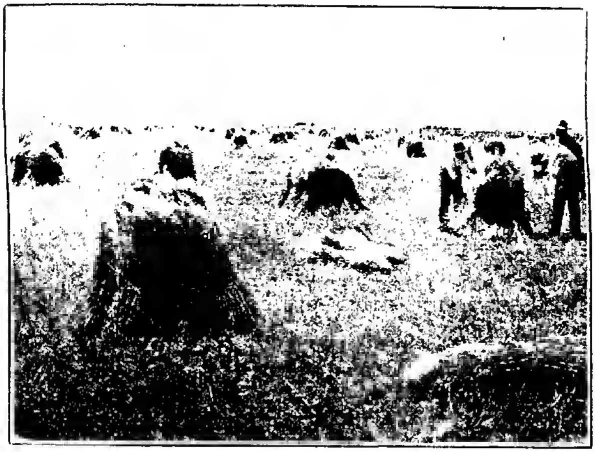
Steady improvement has been effected in the live stock on the farm during the past three years, each annual inspection clearly revealing the progress made. Special attention has been paid to the development of the poultry, and upwards of 2,000 birds are now comfortably housed in up-to-date buildings.

The financial aspect of the farm is also thoroughly satisfactory, although we do not consider that any experimental farm should be expected to pay its way. The many-sided activities and the amount of experimental work carried out preclude any experimental farm being conducted at a profit. In the cereal field alone, for example, over sixty separate plots have been sown with the drill. Each plot requires different treatment and different seed. The drill must be scrupulously cleaned after sowing each plot. Each of the sixty plots must be separately harvested and weighed. In the bulk fields ten different kinds of seed wheat

are grown for distribution among farmers. Each variety has to be kept scrupulously clean, harvested, and stacked separately. All this means greatly increased expenses, and yet it is necessary in the interests of the farmers of the State. For the year ended 30th June, 1916, the experimental farm, after paying experimental work, salaries, and wages, also interest on capital and depreciation charges, gave a net profit of £197. This is exceedingly satisfactory, and indicative of good management.

THE CROPS.

The crops in the bulk fields are excellent. The following varieties have been sown:—Federation, Yandilla King, College Eclipse, Penny, Currawa, Commonwealth, King's Early, Gluyas, Hugenot, Warden and Dart's Imperial. Each block of wheat is singularly free from foreign heads, as might be expected from crops derived originally from hand



Stooking Hay. Wyuna State Farm.

selected heads of wheat. Of these, Federation, Yandilla King, and Penny will give heavy yields this season. Penny is a new variety to this district, and has given very satisfactory yields in the drier districts. It has fine, upstanding clean straw, with a good bold head. Yandilla King has filled out particularly well, and the late rains have proved specially favorable for this late maturing variety. The season has been all against the early maturing wheats. King's Early, Gluyas, and College Eclipse especially where sown early, have been badly knocked about. On the other hand, where these were sown late, they have given much better crops, and have stood well.

A heavy crop of peas was made into pea hay for the use of dairy stock next winter. An interesting test of renovation of old lucerne paddocks may be seen on the irrigated side of the farm. Ten acres of eight-year-

old lucerne was ploughed up in May last, worked down to a fine state of tilth, and sown with ¾ bushel of oats and 6 lbs. of lucerne seed per acre. A luxuriant crop of oaten hay was obtained, and now the young lucerne is coming away nicely. A similar test was made of 10 acres sown with ¾ bushels King's Early wheat and 6 lbs. of lucerne. The wheat was sown thinly to give the young lucerne a chance to develop. Wheat has the advantage over Algerian oats as a nurse crop in that it can be cut at least a fortnight before the oats. Another block of 10 acres of old lucerne is being renovated by sowing millet as a summer crop, and re-sowing lucerne either next autumn or spring. A fine stand of lucerne has been obtained by sowing sorghum on ploughed up lucerne, and following the sorghum with lucerne crop.

EXPERIMENTAL PLOTS.

Among the plots in the experimental fields the selection plots are the most interesting. They have all been sown from hand-selected heads chosen from last year's selection plots, the idea being to gradually improve the prolificacy of each variety by the systematic choice of the best plants each year. The general growth, and the size and quality of the heads in these selection plots are phenomenal, especially when compared with ordinary seed, thus demonstrating the soundness of a system of selection analogous to that used by the experienced stockbreeder.

Among the selection plots are a number of new crossbred wheats originated by the Agricultural Superintendent, Mr. A. E. V. Richardson. Among these there are two that immediately take the eye—a short-strawed, upstanding variety with compact dark brown ears—produced by crossing Clubhead with Yandilla King. This variety did exceedingly well at Werribee last year, and looks a likely type for this district. Another variety, Indian crossed on Comeback, possesses remarkably clean straw, and dense, well-filled heads. This variety yielded 56 bushels per acre at Longerenong last year, and it promises to be among the leaders this year. A third variety, Indian and Federation, is early, and shows phenomenal development of the ears, as compared with other varieties. It is unfortunately weak in the straw, although scarcely more than half the height of Federation. This drawback may be corrected by further selecting. These same varieties are also undergoing trials at Werribee, Rutherglen, and Longerenong.

The Permanent Fertilizer tests should afford information of practical value, as fifteen different combinations of fertilizers have been tested side by side. Heavy and light dressings of super and tests with basic slag, bonedust, sulphate of ammonia, potash, and lime are being tried.

The benefits of early sowing of slow maturing types like Yandilla King and the advantages of late sowing of early maturing varieties like King's Early are strikingly shown in the name of sowing trials. Here Federation, Yandilla King, and King's Early, sown in May, are contrasted with the same varieties sown in July. In the early sown plots the late variety Yandilla King is easily the best, whilst King's Early has been beaten to the ground. In the late sown plots, the Yandilla King is very poor and backward, whilst King's Early is much better head and stands well.

In the rate of sowing trials a series of six plots of Federation sown at various rates are contrasted with six plots sown late. The seedings are

View showing Field Tests with New Crossbred Wheats. Wyuna State Farm.

Seed Selection Tests. Wyuna State Farm.

30 lbs., 45 lbs., 60 lbs., 75 lbs., 90 lbs., 125 lbs. per acre. These plots show conclusively that early sowing economizes seed, and increasing the tilling power of the wheat. The sowing of 45 lbs. sown early appears to be quite equal in thickness to 60-75 lbs. sown late.

Perhaps the most striking feature of the experimental work is the remarkable development of the top dressed natural pastures. The plain land around Wyuna is known to be poor grazing country. Very little trefoil or clover grows on it naturally, nor is there a healthy growth of natural grass. The stock carrying capacity of the pasture on the plain, however, is stimulated beyond all belief by the application of 1 cwt. to 2 cwt. of phosphates. Precisely what changes take place in the soil by such an application of fertilizer may be left to the scientist. To the practical man, however, the results are obvious. The quality of grass improves, the grass grows longer and denser, and a thick mass of trefoil and clover covers the ground like a mat. At least twice the quantity of

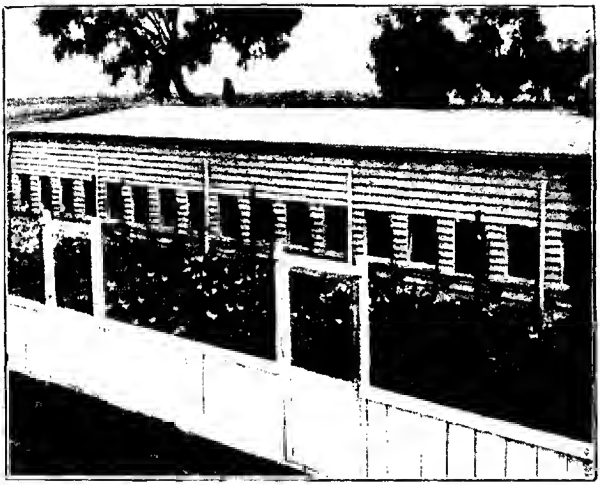
Dairy Building and Silos. Wynna State Farm.

grass grows on the soil, and the quality improves beyond recognition. All through the winter the difference between the untreated and the treated plots showed up prominently. A sharp, clear-cut line of dense foliage divided the manured pasture from unmanured. Such a striking demonstration of the differences in the fertilized and unfertilized plots should draw the attention of northern graziers to this test. Good prices may be expected for wool, sheep, and lambs for some years to come. Nor is it likely, in view of the world-wide shortage of meat, that prices will revert to pre-war levels. This being so, the bearing of these top-dressing tests on increased production is obvious. Four plots have been laid out (1) super., 1 cwt.; (2) super., 1 cwt., and lime, 10 cwt.; (3) no manure or basic slag.

THE LIVE STOCK.

The live stock on the farm are in first-class condition. The dairy herd consists of Jerseys. At the time of our visit eighteen cows were in

milk. The milk from each cow is weighed daily, and regular testings are made to determine the butter fat content of the milk. Only in this way is it possible to make material improvement in the dairy herd, and detect which animals are profitable and which cows are merely boarders. It often happens that a cow which would, on points, do well in a show ring would perform badly before this practical system of testing. In deciding which cows are to be retained in the herd, the animals are arraigned before a jury of three, namely, tho milk scales, the butter fat test, and the milk record. Performance, not appearance, is the criterion. The average milk yield for the whole herd last year was 647.9 gallons, an average fat percentage of 5.2. The average yield of the herd for the year was 337 lbs. of butter fat. While this is a satisfactory yield for a Jersey herd, a survey of the individual records showed the management



View of Brooder House. Wyuna State Farm.

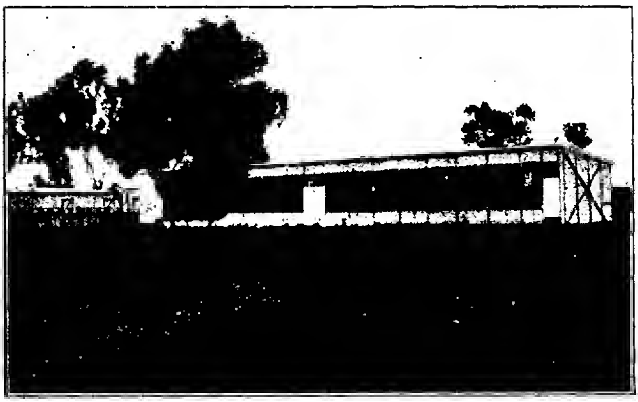
that the yields varied from 444 gallons to 932 gallons per annum, thus indicating further opportunities for culling. Two of the cows gave over 900 gallons. On the other hand, three gave under 500 gallons. The bulk of the herd averages between 600 and 700 gallons. "Breed, feed, and weed" should be the creed of the dairyman. Breed good animals by using the best bulls available; feed them well, and cull the robber cows each year with the aid of the milk scales and Babcock test.

The draught stock are in good condition. There are twenty-six draughts of all ages on the farm. The young stock look particularly well, and give evidence of careful feeding and good management.

In the pig section considerable progress has been made. There are twenty-nine Berkshire pigs, all pedigreed and derived from prize-winning

strains at the Royal show. A recent addition was a boar bred from "Gippsland Queen," a sow which secured the championship at the Sydney Royal Show for the best sow of any breed. Great demand exists for the stock, and pigs are sent all over the State. Twelve pedigreed pigs were sold to settlers for breeding purposes during the past six weeks.

The section that has made the greatest development during the past few years is the poultry. Great credit is due to Mr. Rugg, the poultry manager, for the advances made in this direction. Over 2,000 stud poultry of all ages are now comfortably housed in warm buildings. The great majority of birds are White Leghorns, which breed has established a reputation for laying. Black Orpingtons have also been kept in smaller numbers, and recently a commencement has been made with Rhode Island Reds. This latter breed is especially valuable for table purposes, being well fleshed, and giving heavy weights when dressed. Great saving in labour is effected by housing the birds in a large laying

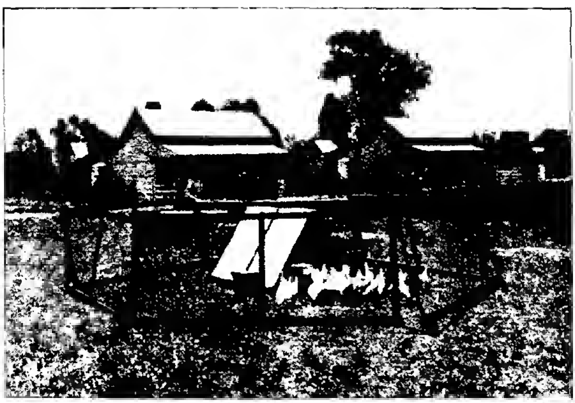


Laying Shed for Housing 500 Pullets. Wyuna State Farm.

shed. The flock is divided into two sections—the commercial section (500 pullets housed in one shed) and the breeding section—housed in neatly constructed pens. The birds are fed on dry mash—bran and pollard mixed, and always available—and grain is thrown at night on the straw in the fore part of the laying shed. Every other day a wet mash containing lucerne and a small allowance of meat meal is fed to the birds. The brooder house presents an interesting sight. Over 1,200 birds have been hatched out this season, and these graduate from the incubators through the brooders, thence to moveable sheds on young rye grass and lucerne pasture, finally to the big shed or cockerel pens. Wyuna is rapidly establishing a name for high-class poultry. Progeny from Wyuna birds held the world's record for egg laying (1,699 eggs for six birds in one season). Both eggs and birds have been sent to every State in the Commonwealth, and also to New Zealand. Over 3,000 eggs of White Leghorns have been distributed as settings to settlers in various

parts of the State. The foundation of the Wyuna strains were prize-winning birds at various egg-laying competitions. Rigorous selection and culling each year has been practised, and now trap-nesting has been

View of Breeding Pens. Wyuna State Farm.



Portable House for Raising Cockerels on Rye grass and lucerne pasture. Wyuna State Farm.

adopted to pick out the most prolific strains for future mating. Six of the birds in one pen at present being tested produced 1,101 eggs from 1st April to 30th November, an average of 183 eggs per bird for eight

months. This is very satisfactory, especially considering the cold, wet weather experienced during the first four months, and that these birds received no special treatment, but were housed and fed exactly the same as all other birds on the farm. All the trap-nested birds, whose records come up to the high standard required of stud birds, will be mated with males bred from the competition winners. A new turkey yard of 2½ acres has been added to the poultry plant, and a warm shed of straw thatch has been built to accommodate 250 American bronzewing turkeys. These birds have proved very profitable at Wyuna, but need careful handling when young, as mortality is higher with young turkeys than with any other class of poultry.

Our visit was most instructive and enjoyable, and we would strongly advise all district farmers who have not yet seen the work being carried out at Wyuna this season to pay a visit to the farm, before harvesting operations are commenced. The manager (Mr. Hugh Baird) will be pleased to show any one round at any time, and will explain the object of the various experiments in wheat culture. It should be interesting to an experienced farmer to compare his impressions while inspecting the wheat plots with the actual records that will be available when the wheat is in bags. Any wheat grower will be amply rewarded for the loss of an hour or two necessary to visit this farm.

KEEP your herd young—very few cows are worth keeping over nine years old.

FAILURE to provide suitable exercise for the herd bull is the reason for many weak calves.

LIKE all machinery, the milking machine may break down once in a while, but it never gets tired.

WHEN garget appears give it careful attention at once. Slight cases are comparatively easy to treat, but if neglected they very often result in attacks so severe that complete recovery is not obtained.

GET the best possible price for your product, but do not forget that the cost of producing the product is far more within the control of the farmer than is the price.

AN optimist is a man who sees an opportunity to make money in each of the complexities of the dairy business. A pessimist is a man who sees a chance for failure in each department of the business.

LIST OF FERTILIZERS REGISTERED UNDER ARTIFICIAL FERTILIZERS ACT FOR THE YEAR 1917.

P. Rankin Scott, Chemist for Agriculture.

The Artificial Fertilizers Act imposes certain obligations on the part of the manufacturer and importer of artificial fertilizers. Amongst the number, one, bearing specially on the registration of brands, is worthy of mention. All manufacturers and importers who intend offering for sale any fertilizer during the year must first register a brand with the Director for Agriculture on or before the 1st day of November in each year. Each application shall set forth the full name and place of business of the applicant, the name, figure, trade mark, or sign to be associated with the fertilizer to identify it, a statement of analyses showing the composition of the fertilizer in respect to the ingredients nitrogen, phosphoric acid, and potash, showing the forms in which they occur, and the retail price of the fertilizer.

The term "form" has reference to the combination of the fertilizing constituent with other constituents. The form of the constituent has a special bearing on its availability. For example, nitrogen is obtainable in three distinct forms—each differing in their availability, viz., as nitrate, ammonia, and organic (bone and animal fertilizers and blood). Phosphoric acid is also obtainable in a number of distinct forms, all of which differ materially in their availability. Following the usual custom a schedule of unit values usually accompanies the published list of fertilizers. The form of the ingredients occurring in fertilizers for which unit value have been computed are given over leaf.

These values are useful, as they afford the means of arriving at the commercial value of a fertilizer. This commercial value can be found by multiplying the percentage of nitrogen, phosphoric acid, or potash content, by the unit value fixed for the ingredient in the form in which it is guaranteed to be present in the fertilizer.

Take for example an ordinary superphosphate showing the following analysis:—

	Per Cent.		Unit Value.		Value per ton.
Phosphoric acid, water soluble,	17·00	×	5/6	=	£4 13 6
.. .. citrate soluble,	0·50	×	4/6	=	0 2 3
.. .. citrate insoluble,	0·50	×	2/-	.	0 1 0
Value per ton		..		..	£4 16 9

It must be understood, however, that as these unit values are computed from simple fertilizers, due allowance should be made for increased cost of a ton of a compound fertilizer, made by mixing two or more of the simple fertilizers, when the price charged for any one of these fertilizers is compared against the commercial value as computed through the use of these unit values. The commercial value as found will serve to illustrate the saving to be made if the buyer bought the simple fertilizers and mixed them during the slack season.

The list of registered brands for the current season are to be found on pages 19, 20, 21, 22, 23 of this issue.

Fertilizers Act 1915.

UNIT VALUES FOR THE YEAR 1917 AS CALCULATED FROM THE DECLARED PRICES OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE.

		s.	d.	
1 per cent. of Nitrogen as Nitrate	is worth	23	3	per ton
1 per cent. of Nitrogen as Ammonia	,,	21	9	,,
1 per cent. of Nitrogen as Blood	,,	17	0	,,
1 per cent. of Nitrogen as Fine Bone	,,	15	6	,,
1 per cent. of Nitrogen as Coarse Bone and Bone Fertilizers	,,	14	6	,,
1 per cent. of Phosphoric Acid as Water Soluble	,,	5	6	,,
1 per cent. of Phosphoric Acid as Citrate Soluble	,,	4	6	,,
1 per cent. of Phosphoric Acid as Citrate Insoluble in Bone Fertilizers, Bone and Supers., and very finely Ground Phosphates	,,	3	6	,,
1 per cent. of Phosphoric Acid as Citrate Insoluble in Supers., Nitro-Supers., and all other Fertilizers	,,	2	0	,,

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1915 (No. 2652).

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.	Potash.	Price asked for the Manure per ton.	Where Obtainable.
		%	%	%	£ s. d.	
Mainly Nitrogenous.						
Nitrate of Soda	Wischer and Co. ..	15·50	..	..	18 0 0	Wischer and Co. Prop. Ltd., William-street, Melbourne
,, ...	M.L.	15·50	..	..	18 0 0	Mt. Lyell M. and R. Co. Ltd., Little Collins-street, Melbourne
,, ...	Sickle	15·50	..	..	18 0 0	Cuming, Smith, and Co. Prop. Ltd., William-street, Melbourne
,, ...	Federal S.N. ..	15·50	..	..	18 0 0	Australian Explosives and Chemical Co. Ltd., William-street, Melbourne
Sulphate of Ammonia	M.G. Co.	20·59	..	..	20 0 0	The Metropolitan Gas Co., Flinders-street, Melbourne
,, ,, ...	Wischer and Co. ..	20·00	..	..	22 10 0	Wischer and Co. Prop. Ltd., William-street Melbourne
,, ,, ...	Hasell's	20·00	..	..	21 0 0	Arthur H. Hasell, 17 Queen-street, Melbourne
,, ,, ...	M.L.	20·00	..	..	22 10 0	Mt. Lyell M. and R. Co. Ltd., Little Collins-street, Melbourne
,, ,, ...	Sickle	20·00	..	..	22 10 0	Cuming, Smith, and Co. Prop. Ltd., William-street, Melbourne
,, ,, ...	Federal A.S. ..	20·00	..	..	22 10 0	Australian Explosives and Chemical Co. Ltd., William-street, Melbourne
Dried Blood	S.C.D.B.	10·00	1·00	..	9 0 0	Sims, Cooper and Co. (Australia) Prop. Ltd., The Olderfleet, Collins-street, Melbourne
,, ...	Imperial	11·00	..	..	9 0 0	W. Angliss and Co. Prop. Ltd., 42 Bourke-street, Melbourne
,, ...	Rohs	10·00	..	..	10 0 0	W. Rohs Prop. Ltd., Bridge-street, Bendigo
Blood Manure	M.C.C.	7·76	1·22	0·58	5 5 0	The Melbourne City Council City Desiccating Works, Smithfield-road, Kensington

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1915—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. Citrate In-soluble.	Phosphoric Acid. Total.	Potash.	Price asked for the Manure per ton.	Where Obtainable.
		%	%	%	%	%	%	£ s. d.	
Phosphatic, readily Soluble. Superphosphate ..	Wischer and Co. No. 1	..	17·00	0·50	0·50	18·00	..	4 15 0	Wischer and Co. Propty. Ltd., William-street, Melbourne
.. .. ..	Hasell's	..	17·00	0·50	0·50	18·00	..	4 15 0	Arthur H. Hasell, 17 Queen-street, Melbourne
.. .. ..	M.L. No. 1 Super...	..	17·00	0·50	0·50	18·00	..	4 15 0	Mt. Lyell M. and R. Co. Ltd., Little Collins-street, Melbourne
.. .. ..	Sickle, Florida Super.	..	17·00	0·50	0·50	18·00	.	4 15 0	Cuming, Smith and Co. Propty. Ltd., William-street, Melbourne
.. .. .	J. Cockbill's ..	..	17·00	0·50	0·50	18·00	..	5 0 0	John Cockbill, 407 Post Office-place, Melbourne
.. .. ..	Federal O.S. ..	..	17·00	0·50	0·50	18·00	..	4 15 0	Australian Explosives and Chemical Co. Ltd., William-street, Melbourne
.. .. ..	Rohs	..	16·50	0·50	0·50	17·50		4 17 6	P. Rohs Propty. Ltd., Bridge-street, Bendigo
Concentrated Superphosphate	Wischer and Co. ..	..	40·00	4·00	..	44·00	..	13 10 0	Wischer and Co. Propty. Ltd., William-street, Melbourne
. ..	M.L.	..	40·00	4·00	..	44·00	..	13 10 0	Mt. Lyell M. and R. Co. Ltd., Little Collins-street, Melbourne
.. .. ..	Sickle	..	40·00	4·00	..	44·00	..	13 10 0	Cuming, Smith and Co. Propty. Ltd., William-street, Melbourne
.. .. ..	Federal Conc. S. .	..	40·00	4·00	..	44·00	..	13 10 0	Australian Explosives and Chemical Co. Ltd., William-street, Melbourne
Phosphatic, difficultly Soluble. Ground Phosphate ..	M.L. (60 %) ..	..	..	..	27·43	27·43	..	3 15 0	Mt. Lyell M. and R. Co. Ltd., Little Collins-street, Melbourne
.. ..	M.L. (80 %) ..	..	..	.	36·65	36·65	..	5 0 0	" " " "
.. ..	Sickle (50 %) ..	..	..	..	23·00	23·00	..	3 10 0	Cuming, Smith and Co. Propty. Ltd., William-street, Melbourne
.. ..	Sickle (80 %) ..	..	..	..	36·65	36.65	..	5 0 0	" " " "
.. .	Wischer and Co. (80 %)	..	..	..	36·65	36·65	..	5 0 0	Wischer and Co. Propty. Ltd., William-street, Melbourne
.. ..	Federal G.P. ..	..	..	..	36·65	36·65	..	5 0 0	Australian Explosives and Chemical Co. Ltd., William-street, Melbourne
.. ..	Marion Phosphate (60 %)	..	..	..	27·50	27·50	..	4 0 0	Arthur H. Hasell, 17 Queen-street, Melbourne
Very finely ground and roasted Phosphate	Victoria Phosphate No. 1	..	..	3·00	14·00	17·00	..	3 3 6	Heathcote Chemical Co. Propty. Ltd., Sutton-street, North Melbourne
" " ..	Victoria Phosphate No. 2	..	..	2·00	13·00	15·00	..	2 17 6	" " " "

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1915—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. Citrate In-soluble.	Phosphoric Acid. Total.	Price asked for the Manure per ton.	Where Obtainable.
		%	%	%	%	%	£ s. d.	
Containing Phosphoric Acid and Nitrogen, readily available.								
Nitro Superphosphate ..	M.L. (nitro super and, or, rape manure)	‡ 2·00	13·00	0·38	1·37	14·75	6 10 0	Mt. Lyell M. and R. Co. Ltd., Little Collins-street, Melbourne
,, ..	Sickle	‡ 2·00	13·00	0·39	1·61	15·00	6 10 0	Cuming, Smith and Co. Propty. Ltd., William-William-street, Melbourne
,, ..	Federal N.S. ..	‡ 2·08	13·18	0·38	1·71	15·27	6 10 0	Australian Explosives and Chemical Coy. Ltd., William-street, Melbourne
,, ..	Wischer and Co. ..	‡ 2·06	13·92	0·41	0·41	14·74	6 10 0	Wischer and Co. Propty. Ltd., William-street, Melbourne
,, ..	Wischer and Co., "Key Fertilizer"	* 1·55	15·30	0·45	0·45	16·20	6 10 0	,, ,, ,, ,, ,,
Bone and Super "A" ..	Hasell's	1·50	8·50	3·00	7·00	18·50	5 14 0	Arthur H. Hasell, 17 Queen-street, Melbourne
Blood Bone Dust and Super	Rohs	4·00	5·50	6·25	2·25	14·00	7 0 0	P. Rohs Propty. Ltd., Bridge-street, Bendigo
Bone Dust and Super ..	Rohs	1·50	8·50	5·25	4·25	18·00	5 17 6	,, ,, ,, ,, ,,
Containing Phosphoric Acid and Nitrogen, moderately available.								
Bone Manure	J. Cockbill's Bone Manure	6·00	..	5·00	10·00	15·00	7 10 0	John Cockbill, 407 Post Office-place, Melbourne
Bone Fertilizer	J. Cockbill's Bone Fertilizer	3·50	..	3·50	14·75	18·25	6 0 0	,, ,, ,, ,, ,,
Blood and Bone ..	S.C.B.B. ..	5·50	..	6·60	7·40	14·00	7 0 0	Sims Cooper and Co. (Australia) Propty. Ltd., The Olderfleet, Collins-street, Melbourne
Bone Dust and Blood ..	Rohs	6·00	..	6·50	5·00	11·50	8 5 0	P. Rohs Propty. Ltd., Bridge-street, Bendigo
Animal Fertilizer ..	Lighthouse Fertilizer	3·00	..	3·00	12·00	15·00	6 10 0	Thomas Borthwick and Sons (Australasia) Ltd., William-street, Melbourne
,, ...	Valley Fertilizer ..	6·75	..	7·00	4·25	11·25	6 12 6	Goulburn Valley Industries Co. Ltd., Freezing Works, Shepparton
Bone Fertilizer	Ark Bone Fertilizer	3·72	..	3·98	12·90	16·88	6 10 0	Arthur Murphy, Ararat
,, ...	Horseshoe Bone Fertilizer	3·50	..	4·70	10·70	15·40	5 15 0	Patrick Fitzgerald, Warragul-road, Bentleigh
,, ...	A.N.A. Surprise Animal Fertilizer	3·00	..	4·00	12·00	16·00	7 0 0	G. W. Pennell, Braybrook
,, ..	Samson's Bone Fertilizer	2·00	..	2·00	15·00	17·00	5 7 6	George Gardiner and Co. Propty. Ltd., Marshalltown, Geelong
,, ...	Gardiner's Special Magic Fertilizer	5·00	..	3·00	10·00	13·00	6 10 0	,, ,, ,, ,, ,,
,, ..	Gardiner's No. 1 Magic Fertilizer	2·00	..	2·00	15·00	17·00	5 7 6	,, ,, ,, ,, ,,
,, ...	Gardiner's No. 2 Magic Fertilizer	1·50	..	1·50	14·50	16·00	5 2 6	,, ,, ,, ,, ,,

List of Fertilizers Registered at the Office of the Director of Agriculture under the Fertilizers Act 1915—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid. Water Soluble.	Citrate Soluble.	Citrate In-soluble.	Total.	Price asked for the Manure per ton.	Where Obtainable.
		%	%	%	%	%	£ s. d.	
Special Manures containing Phosphoric Acid and Nitrogen, readily available								
Vine No. 2, Mildura ..	M.L. ..	.. * 7·13	9·18	0·27	0·27	9·72	11 5 9	Mt. Lyell M. and R. Co. Ltd., Little Collins-street, Melbourne
Vine No. 4, Mildura ..	M.L. ..	.. † 9·20	9·18	9·27	0·27	9·72	13 5 0	" " " " "
Apricot and Peach, No. 2, Mildura	M.L. ..	.. † 5·75	12·11	0·35	0·36	12·82	10 5 9	" " " " "
Mildura Vine No 2 ..	Sickle ..	.. * 7·13	9·18	0·27	0·27	9·72	11 5 0	Cuming, Smith and Co. Propty. Ltd., William-street, Melbourne
Mildura Vine No. 4 ..	Sickle ..	.. † 9·20	9·18	0·27	0·27	9·72	13 5 0	" " " " "
Mildura A. and P. No. 2 ..	Sickle ..	.. * 4·45	12·11	0·35	0·36	12·82	9 9 9	" " " " "

Note.—* Containing Nitrogen as Nitrate of Soda.
† Containing Nitrogen as Sulphate of Ammonia.
‡ Containing Nitrogen as Sulphate of Ammonia and Organic.

LIST OF FERTILIZERS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE FERTILIZERS ACT 1915—*continued.*

Description of Manure.	Brand.	Nitrogen.	Phosphoric Acid.	Mechanical Condition.		Price asked for the Manure per ton.	Where Obtainable.
				Fine.	Coarse.		
		%	%	%	%	£ s. d.	
Bone Dust	Vauxhall ..	3·86	23·25	33·7	66·3	7 10 0	William Moore, Panmure
"	J.N.D.—B. ..	4·23	20·87	33·0	67·0	6 5 0	John N. Day, Jennings and Day streets, Bendigo
"	Marvell	3·74	23·62	36·0	64·0	6 10 0	Spriggs and Porter, Benalla
"	Rohs	4·00	18·00	55·0	45·0	6 15 0	P. Rohs Pty. Ltd., Bridge-street, Bendigo
"	Tooram .. .	3·62	21·74	28·5	71·5	7 0 0	Alfred Morgan, Tooram, Allansford
"	Turner Bros. Brown Hill	2·50	18·00	30·0	70·0	7 0 0	Alfred A. Turner, 405 Humffray-street, Ballarat East
"	Thos. Brown. Ox Bone dust	3·15	22·00	33·0	67·0	6 0 0	Executors of Thos. Brown, Hamilton
"	Lion .. .	3·85	21·50	31·0	69·0	6 10 0	Alfred Wray, Raymond-street, Sale

Government Laboratory,
Melbourne, 7th December, 1916.

P. R. SCOTT.
Chemist for Agriculture.

APPLE CULTURE IN VICTORIA.

Continued from page 727, Vol. XIV. (11th December, 1916.)

By J. Farrell, Orchard Supervisor.

Pruning the Jonathan.

In consequence of its general adaptability to a wide range of soil and climatic environments, its consistant fruit-producing characteristics under the various conditions, when scientifically managed, and the ever-increasing popularity of its fruit, both on the local and export markets, the Jonathan is one of the most extensively cultivated and profitable varieties in this State.

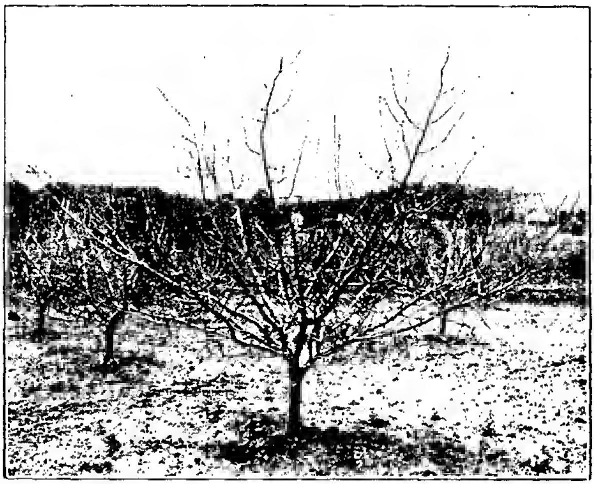


Plate 52.—Ten-year-old Jonathan unpruned.

For many years the pruning treatment of the Jonathan has engaged the serious attention of orchardists and pruning experts alike. Similar to most other varieties, its habit of growth is, to a great extent, influenced by the class of soil on which it is cultivated. Rich land produces an upright vigorous tree, which requires hard pruning for the first three or four years in order to divide up its branch system into a large number of leaders, so as to suit local conditions, and the crop producing requirements of the orchardist.

When a tree with too small a number of leaders is growing on land with a high standard of fertility, rank wood with long internodes is usually produced annually. The buds on this class of leader, instead of producing light fruitful laterals during the second year of their growth, invariably send out strong, unfruitful ones. This may be prevented to a great extent by providing for the excessive multiplication of the leaders

which, on account of their number, produce a greater amount of small laterals, and of a more fruitful character.

A Jonathan on poor soil grows less upright, and it needs hard pruning during its youth to secure the number of leaders required under the circumstances, and afterwards to keep them stiff and more upright than they would otherwise be if left to their own resources. A tree on this class of soil usually comes into bearing early in life, and this further retards its growth. Heavy crops of fruit bend the leaders down, and when it is picked, they are rarely able to regain their original positions, except when kept stiff and strong by hard pruning.

The Jonathan grown on soil of average fertility is, generally speaking, more amenable to pruning treatment than those cultivated under the extremes just explained. Its leaders are, as a rule, of medium strength, and densely clothed with a suitable class of fruit laterals.

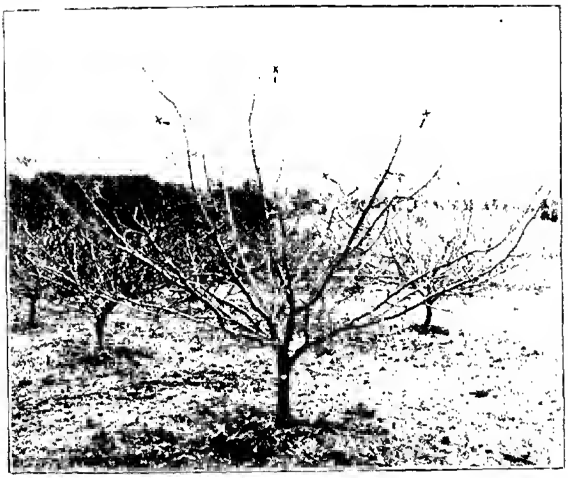


Plate 53.—Same tree Pruned.

When trees of this class are placed in the hands of a scientific pruner, all other conditions being favorable, the proposition of securing the highest results becomes a matter of simplicity itself.

Plate 52 is a ten-year-old unpruned Jonathan tree, showing a plentiful supply of light laterals. It is a consistent bearer, and growing on fairly rich Silurian soil. Its leaders are radiating at a rather open angle from the vertical, owing to their inability to regain their proper position when relieved of their fruit. This could have been prevented to some extent had the leaders been pruned harder during the first four or five years of the tree's growth.

Plate 53 shows the same tree pruned under the approved method. The bottom leader, on account of its rather low position, was removed. The strong upright laterals were pruned away, while the weaker pendulous ones were retained. Where the lateral growths became rather long,

through extending more than 10 or 12 inches from the leaders, they were shortened back to the light yearling twigs marked (x), a few inches away from their base. When it is optional the twigs holding horizontal, or pendulous positions, should be selected for this purpose, in preference to vertical ones. When the tree is making a strong growth and the light twigs are utilized in the manner as described, there is often a danger of them becoming too strong during the second year of their growth. When this danger is apparent, the removal of the portion as

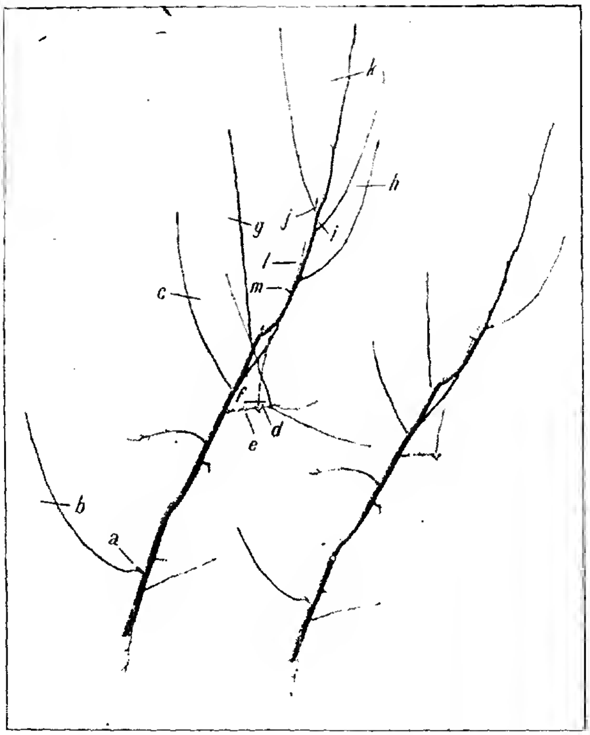


Fig. 1. Fig. 2.

Plate 54.—Jonathan leader unpruned, and same leader Pruned.

suggested may be deferred for another year, until the twigs have hardened their wood, and built up their fruit buds, when the operation may be performed with safety at the next winter pruning.

TREATMENT OF INDIVIDUAL JONATHAN LEADER.

Plate 54, Fig. 1, shows Jonathan leader unpruned, and the method of treatment in its case recommended as depicted. The previously

developed fruit bud (*a*) fruited last year on the then three-year-old wood, and also sent out the lateral which is rather long, and may be next pruned at (*b*). Next year it will extend from that point, and fruit buds will be built up between (*b*) and (*a*). The extension may be removed at the following pruning by cutting back into the two-year-old wood to the next fruit bud below (*b*). For like reasons three of the laterals above may be pruned at (*c*, *g* and *h*), as indicated, and they may also be subsequently worked back as previously explained. But for the sparsely supplied lateral growths along the leader, these might be removed like (*i* and *j*), the suppression of which will enable the buds (*l* and

Plate 55.—Five Jonathan laterals shown. Ancient and modern methods of Pruning same.

m) to lengthen somewhat. If cut at (*d*) the fruit wood on the right will send out light growths from the bud (*e*), and from the others between it and (*d*). The vertical growth may be retained for one year to insure steady devlopment of the desired light laterals, when having fulfilled this object, it may be removed (*f*) at the subsequent pruning. The alternative method of working this piece of fruit wood is to remove the two upright growths, and retain the two horizontal ones. In consequence of the horizontal growths being weak, probably this would be the better method, the shorter one might be retained, and the longer cut back to about half its length. The leader, when growing at an angle of 40

degrees from the vertical, is pruned to an outer bud like (*k*) at a reasonable distance from the base of the yearling growth on the two-year-old wood. Should too open an angle be described by the leader, an inside bud may be utilized to bring it up to the correct angle. In case the leader which is being pruned inclines towards a neighbouring one in the circle, proper spacing may be encouraged by cutting to a light lateral or bud on the opposite side to which it leans.

Treatment of Jonathan Laterals.

Before the habits of the Jonathan laterals were so well known, and before the pruning treatment necessary in order to obtain the best results from this variety was so well understood, as it is at present, fruit-growers frequently pruned them too hard year after year.

Plate 55, Figs. 1 and 2, are specimens which show the result of this treatment. These were pruned short for six and five years respectively

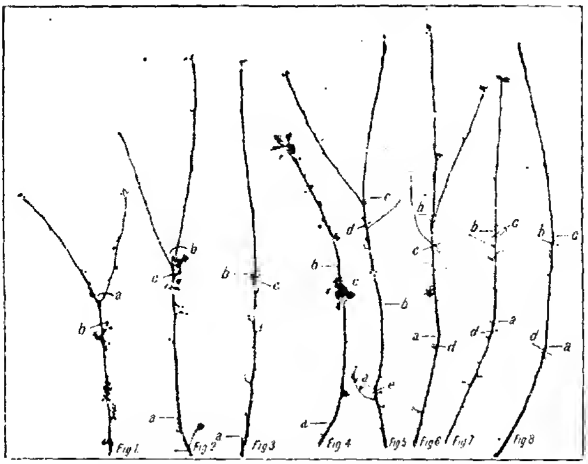


Plate 56.—Various types of Jonathan laterals.

without developing a single fruit bud between the last cuts and the base of the laterals. But. when allowed to go unpruned, they developed fruit buds along the two-year-old wood above the last cuts. The modern treatment applied to the laterals of this variety, and to others of similar habit, is to allow them to go unpruned for the first year like Fig. 3. During the second year, they fruit on the terminal buds, or extend from that point, like Fig. 4, and during the same period the leaf buds along the yearling wood are developed into fruit buds by the time it is two years old. At next pruning they are cut to about 12 to 15 inches long, according to the vigour of the tree. to fruit buds on the two-year-old wood, like Fig. 5. When the yearling laterals are exceptionally long and light, they should be shortened back the first year, because, when allowed to remain at full length, they usually build up their best fruit buds near their points, and too far away from the leader. If shortened

back to a reasonable lcugth, fruit bud and spur development is encouraged in a more suitable position in relation to the leader.

Plate 56 shows a series of eight laterals of the types which usually appear on trees, the pruning of which has been neglected, or imperfectly peformed. Although the renovation by pruning essential to trees in this condition invariably presents an insurmountable task to the inexperienced

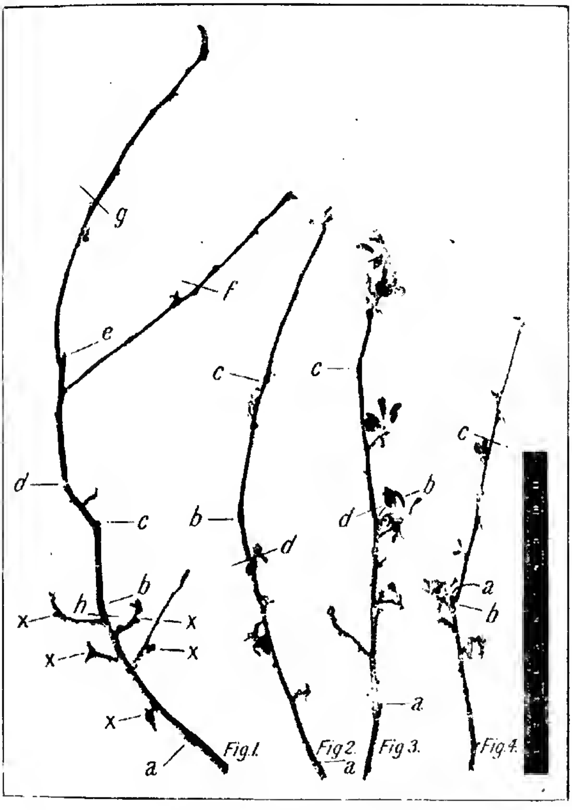


Plate 57.—Four Jonathan laterals showing necessity for shortening back.

fruit-grower, yet, when taken in hand by a scientific pruner, with a thorough knowledge of the habit of growth of the variety to be prnued, its treatment becomes a comparatively simple proposition.

Fig. 1 is a two-year-old lateral which extended to (a) the first year. During the second year, it fruited on the terminal bud, and produced the two light twigs which appear above that point. To reduce this growth to a reasonable length, and encourage the development of spurs near its

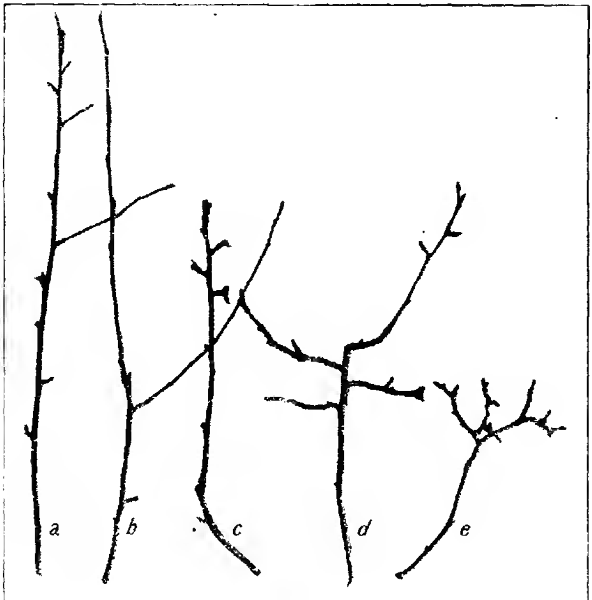


Fig. 1.

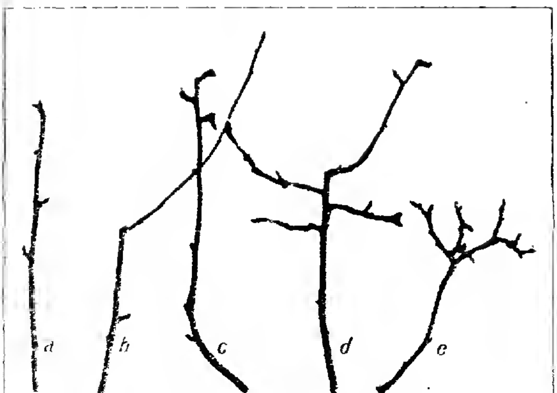


Fig. 2.

Plate 58.—Five Jonathan laterals of the class usually found on well-pruned trees.

base, it should have been cut, this year, at (*b*), in the two-year-old wood. Fig. 2 is three years old. It extended the first year to (*a*), the next year it fruited at that point, and sent out the shoot which extended beyond (*b*), but it was pruned back to that point last year. The result of this cut was the production of the two light growths, and the development of the fruit buds on the two-year-old wood. Instead of being allowed to remain unpruned this year, it should have been cut in the two-year-old wood at (*c*), for similar reasons advanced in the case of Fig. 1. Fig. 3 is also three-year-old. The yearling lateral was cut too short at (*a*) the first year. The growth sent up to (*b*) was not pruned back last year, nor did it fruit on the terminal bud, but it produced the yearling growth, and built up the fruit buds on the two-year-old wood. This specimen should have been cut this year at (*c*), or a few buds lower down, according to the

Plate 59.—One, and two year old Jonathan laterals showing fruiting habit.

length of lateral desired. It will be understood that the more sparsely the tree is supplied with this class of wood the longer will be the portions retained. Fig. 4 fruited at (*a*) two years ago, and made the extension, which was pruned at (*b*) last year, when it further extended from that point. The cut (*c*) would have been the correct one this year. Fig. 5 is four years old. It commenced by growing to (*a*) the first year. Fruit was produced on that point, and an extension made to (*b*) the second year. The third year it further extended to (*c*). Last year fruit was produced on the terminal bud in addition to the two growths on top. To prune this specimen this year, it might have been cut at (*d*), and worked back gradually, but if the tree is plentifully supplied with fruit wood, the more drastic treatment by cutting at (*e*) would be preferable. Fig. 6 ran to (*a*), then to (*b*), where it fruited, and produced the growths on top. In

pruning this question, the better plan would be to cut at (*c*), and work back gradually to (*d*), with a view to developing the dormant buds below that point. Fig. 7 grew to (*a*), and next to (*b*), but instead of allowing it to extend from (*b*) upwards last year, it should have been cut back in the two-year-old wood to (*d*). By this means the sap, that went to make superfluous wood, would have been utilized to build up the fruit spurs on the three-year-old wood below (*d*). Probably the best cut this year would be (*d*), or the specimen might be cut at (*c*), and subsequently worked back as explained in connexion with Fig. 6. Fig. 8 is somewhat similar to Fig. 7, except that there are no short growths on its two-year-old wood. It is a good example of the fallacy of allowing the laterals to become too long through want of careful management and knowledge of their treatment. The lettering on this specimen may be followed similarly to Fig. 7. As a lateral makes its yearly extensions, the strongest and best fruit buds are usually found to be on the two-year-old wood, near the current year's growth. This happens in consequence of the fruit buds in that position receiving a greater quantity of the elaborated sap, from the leaves of the young wood growths on its return flow, than the buds near the base of the lateral. Hence the necessity for maintaining the extensions, if any, near the points where the fruit buds and spurs are desired.

Plate 57 shows four specimens of Jonathan laterals which are of a good type, but they have arrived at that stage, like those in plate 56, when it is necessary to shorten them back in order to obtain the best fruit-bearing results from them in the future. The tree from which they were taken has been kept regularly pruned, but the operator evidently lacks that knowledge which would have enabled him to complete his work in a scientific manner, as he allowed these laterals to remain unpruned this year. Fig. 1 grew off the leader to (*a*), where it fruited on the terminal bud, and extended to (*b*), during the second year. Then it lengthened to (*c*), where it again fruited on the terminal bud, and also grew to (*d*). The growth which was made from (*d*) upwards was cut at (*e*) last year, and the result was the two yearling growths on top. When pruned at (*e*) last year the correct cut would have been (*h*). This treatment would have resulted in conserving the sap for the use of the fruit spurs, marked (x), which are a nice distance from the leader, and have been fruiting for the last two years. Had the person who cut at (*e*) last year again pruned this year, he would probably have pruned to the wood buds (*f* and *g*). This would still further exaggerate the evil by opening up the young sap channels, and producing more wood on top at the expense of the fruit spurs. It is obvious that, having been neglected on the last occasion, (*h*) would have been the proper cut this year. Fig. 2 fruited on a short growth at (*a*), after which it grew to (*b*, *c*), and to the point during the next succeeding three years respectively. Last year it should have been cut back to (*d*) in the then two-year-old wood, failing which it should have been pruned at that point during the last pruning season. Fig. 3 was cut too short in the yearling wood at (*a*) five years ago. It extended to (*b*), and fruited on that point the following year, and also lengthened to (*c*). The portion of wood above (*c*) is three years old. This lateral might have been cut back to (*d*) about 10 inches long at last pruning time. Fig. 4 was cut back at (*a*) into the two-year-old wood to a fruit bud, as recommended in the case of Figs. 1, 2, 3, and 4, plate 36. Instead of retaining its fruitfulness, however, this bud made the yearling growth above (*b*) in consequence of the sap pressure put on to it. Probably no further

extension would take place if the lateral were cut back in the three-year-old wood at (*b*). Should the tree be insufficiently supplied with wood of this class, however, the lateral may be cut at (*c*) about 12 inches long, and worked back from that point next year, as previously explained.

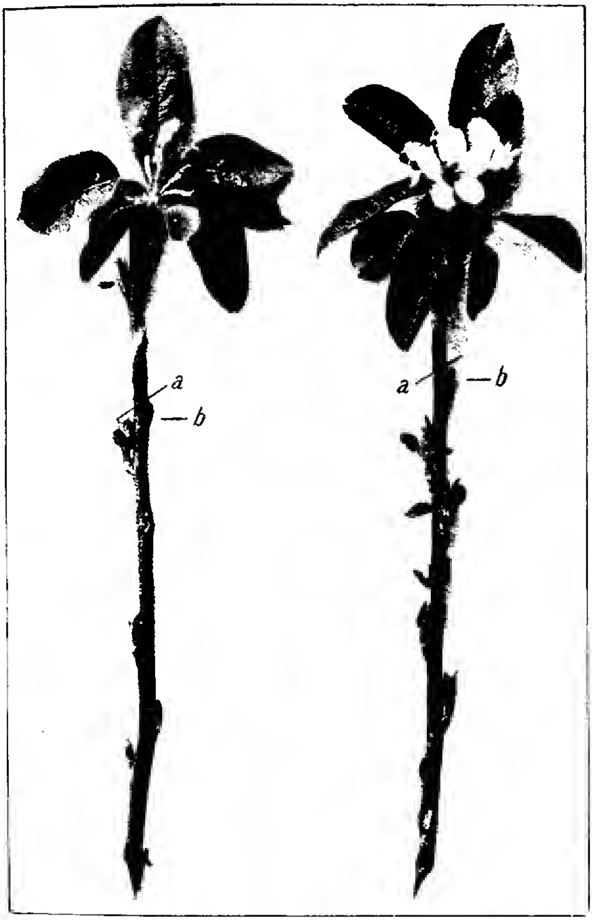


Plate 60.—Yearling leader growths, showing blossoms on uppermost buds.

Plate 58 depicts five laterals of the class usually found on Jonathan trees growing on fairly rich soil, and in the case of which annual systematic pruning has been practised. Fig. 1 (*a*) is two years old. It was left unpruned last year, and fruited on the terminal bud, as the fruit

scar indicates. Most of the leaf buds were developed into fruit buds, and three short growths were produced. Fig. 1 (*b*) is also two years old, and it was cut in proportion to the strength of its wood rather short last year. Fig. 1 (*c*) shows fruit spurs on the three-year-old wood, naturally built up. Fig. 1 (*d*) is a specimen produced by first cutting the one-year-old wood, and afterwards pruning back into the two-year-old wood, as previously explained in connexion with other specimens. Fig. 1 (*e*) was a short lateral which fruited on the terminal bud, and subsequently furnished itself with natural fruit spurs, no extensions being produced. Fig. 2 shows the same specimens, and in the same order, as the lettering will indicate, pruned according to their individual needs.

Plate 59 is five specimens showing the blossoming characteristics of one, and two year old Jonathan laterals. These were all taken from the same tree, and none of them have been pruned. Fig. 1 is one year old, and it has produced no blooms, the buds not having been sufficiently developed. On account of being rather too long, it should have been pruned at (*a*) this year so as to still further encourage the building up of the buds below (*b*). Fig. 2 is two years old, and although the buds along it seemed well developed in early spring, yet no blossoms were produced. Healthy foliage is the forerunner of fruit on this class of wood, and by pruning at (*a*) next year a typical piece of fruit wood will be conserved. Fig. 3 is one year old, and showing blossoms on the terminal bud; this occurs on about 20 per cent. of Jonathan laterals of its age. It may be cut at (*a*) next year so as to strengthen the buds below that point. The fruit produced on the points of yearling Jonathan laterals is usually small, and of inferior quality. Fig. 4 is also one year old, but instead of blossoming on the terminal bud, the apparently normal leaf buds along the lateral produced blooms. The fruit rarely sets when placed in this position, on yearling laterals. Like Fig. 1, this lateral is much too long, and should have been cut at (*b*) this year, so that the bud (*c*) and those below it might be still further developed during the present vegetative period. However, it may be pruned at (*a*) next year. Fig. 5 is two years old, and blooming along its full length. The oldest blooms are in clusters near the terminal, where the petals have fallen, and the fruit has set. Buds in full bloom appear in the centre of the lateral, while some of those near its base have not yet opened. This is a further illustration of the sap after rising, and when elaborated, being utilized first to feed the buds near the terminal or highest point. By cutting this lateral at (*a*) next year an extremely fruitful piece of wood will be retained, and this may be further shortened subsequently should occasion require it.

It has been stated that the blossoms showing on the lateral Fig. 4 were produced from apparently normal leaf buds. But yearling leader extensions also frequently blossom on buds of similar appearance along these growths. The Rome Beauty is one of the varieties on which this habit of blooming is most noticeable, but this rarely happens until the trees are over five years old. However, when yearling leader extensions on three and four-year-old trees are cut too long, and more particularly if treated early in the pruning season, instead of producing the further leader extensions desired, they often blossom on the terminal buds.

The specimens in Plate 60 are one year old, taken from a four-year-old tree, and they illustrate the tree's blossoming potentiality in this respect. When pruned, these leaders were cu too long, and consequently the flow of sap to the terminal buds were more gradual than if they were

pruned at (a), and enabled to extend from the buds (b). All the buds below those in blossom are producing leaves only. Had the cuts been made at (a), as described, the rush of sap to the buds marked (b) would have been more rapid. This would probably not have allowed sufficient time for the leaf buds to develop into blossom, and wood extensions would have been produced.

Although the blossom buds, developed during early spring from the previous year's leaf buds, usually open freely, and the principal organs of the flowers are mostly apparently healthy in every respect, yet they rarely set well, and the few fruits produced on them are generally bad types, and of inferior quality. The most satisfactory results in this

Plate 61.—A row of eight-year-old Jonathan trees.

regard are obtained from the round, plump blossom buds which were developed from the leaf buds of the previous year's yearling wood, on the ripening two-year-old wood, during the last period of vegetation. Blossoms on their points not only give the leaders a stunted appearance, but in consequence their lighter extensions, which are usually near the base of the fruit stalks, often strike off at an unsuitable angle. Whereas if the uppermost buds are made to produce wood in the proper manner the angle at which it should grow may be regulated to a nicety.

Plate 61 is a view of a row of eight-ear-old Jonathan trees, showing their condition after the fruit was picked, and the amount of wood growths produced during the current period of growth. These are good croppers, and the land on which they are growing is Silurian formation of average fertility, but when thorough cultural treatment and liberal feeding of the trees are practised, the Jonathan is one of the varieties which respond freely by supplying a succession of suitable fruiting wood as well as in fruit production.

(To be continued.)

2 2

BEE-KEEPING IN VICTORIA.

By F. R. Beuhne, Government Apiculturist.

XXVI. THE HONEY FLORA OF VICTORIA.

Continued from page 693, Vol. XIV. (10th November, 1916).

The Coast Banksia (*Banksia integrifolia.*)

Fig. 57.

There are over forty species of Banksia, but five only occur as natives in Victoria, of which the Coast Banksia is the largest, developing sometimes into a tree 40 to 50 feet high, with a trunk diameter up to 4 feet.

Fig. 57.

It is commonly known as Honeysuckle, Tree-Honeysuckle, and most appropriately as Coast Honeysuckle, on account of the situations it frequents. It is also called White Honeysuckle to distinguish it from Red Honeysuckle (Banksia serrata), the timber of which is far redder. The botanical name of this group, "Banksia," is in honour of Sir Joseph Banks, who, for long, was president of the Royal Society of London,

while the specific name, integrifolia, signifies "entire leaf," in reference to the margin of the leaf.

The leaves are lance-shaped, or oblong, wedge-shaped, blunt-ended, quite entire, but sometimes irregularly toothed, 3 to 4 inches long, in some specimens much longer, and from ½ to near 1 inch broad; white underneath, with a not very prominent network of veins. The young shoots and young leaves are covered with woolly hair till nearly full grown. Flower spikes from 3 to 6 inches long, oblong, cylindrical. Fruit cone oblong, cylindrical, seed capsules prominent, but not thick as in the Saw or Red Banksia (Banksia serrata).

The Coast Banksia is found in the south-east of Victoria, but it has also been reported from the Grampians.

The timber is pinkish in colour, beautifully grained, and takes a good polish; it is, however, but little used as an ornamental timber, being employed chiefly for ribs and knees in boats, bullock yokes, &c.

The flower is, as a rule, a profuse yielder of both nectar and pollen. The honey obtained from it is somewhat high-coloured, rather strong, and has a distinct aroma peculiar to the Banksias; it candies quickly and hard.

THE SILVER BANKSIA (*Banksia marginata*).

Fig. 58.

The Silver Banksia, generally known as "Honeysuckle," is the most widely distributed of the Victorian species, being found east, west, north,

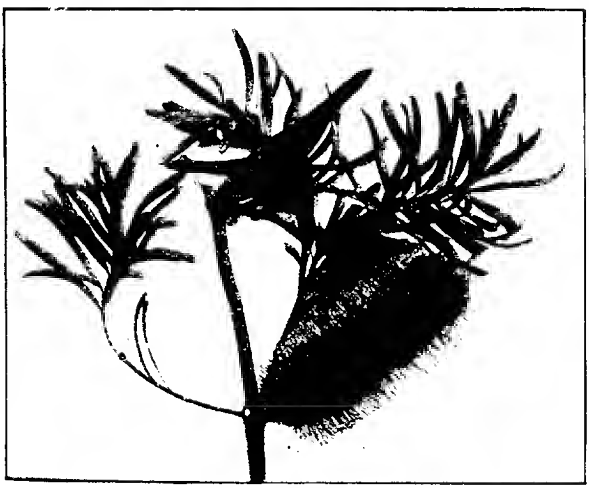


Fig. 58.

and south. It is usually a bushy shrub of from 10 to 15 feet high, growing sometimes into a tree of considerable size, sometimes low, straggling, or depressed.

Leaves broadly linear, or oblong, lance-shaped, blunt, often square at the ends, usually smooth-edged, 1 to 2 inches long, but in flowerless

branches, or even on some flowering specimens, some or all the leaves are much larger, more or less toothed, all leaves very white underneath (hence the common name).

Flower spikes oblong, cylindrical, 2 to 3, rarely 4 inches long; in some dwarf varieties nearly globular.

Fruit cone oblong, cylindrical; seed capsules prominent, not thick, rounded, ½ inch broad, at first covered with hair.

The wood is soft, porous, and spongy; when dead, and in a certain stage of decay, it makes the best fuel for the beekeepers' smoker, the smoke given off being clean, cool, and of not unpleasant odour.

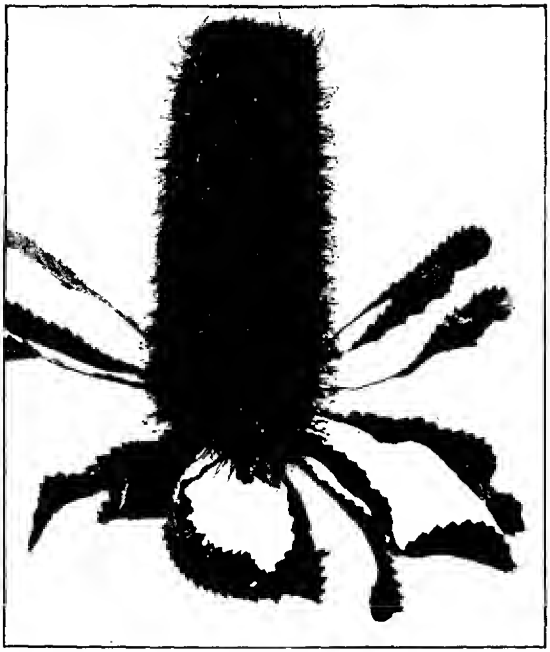


Fig. 59.

The flower yields nectar and pollen freely after good autumn rains. The honey is somewhat strong, and candies quickly. The Silver Banksia blossoms in some districts from February to May; in others from April to July. Near the Grampians, there is a dwarf form as well as the normal type, from which it in no way differs botanically.

In many localities where the Silver Banksia was formerly plentiful, it is now almost extinct. The former trees have died of old age, or have been cut down in drought seasons as feed for stock, by which the leaves are so readily eaten, that no seedlings survive.

THE SAW BANKSIA (*Banksia serrata*).

Fig. 59.

A bushy tree confined to the east of Victoria. The leaves are oblong, lance-shaped, pointed or blunt, regularly and deeply toothed, 3 to 6 inches long, ½ to 1 inch wide, leathery and flat, hoary or rarely white underneath.

Flower spikes oblong, cylindrical, very thick, 3 to 6 inches long. Fruiting cone matted, hairy; seed capsules very prominent, thick, and hard, about 1 inch broad.

Wood, purplish, mahogany coloured, useful for furniture.

The Saw (or Red) Banksia flowers in December and January.

No authentic information as to its value to the beekeeper is, up to the present, available, and the writer would be grateful to any one who,

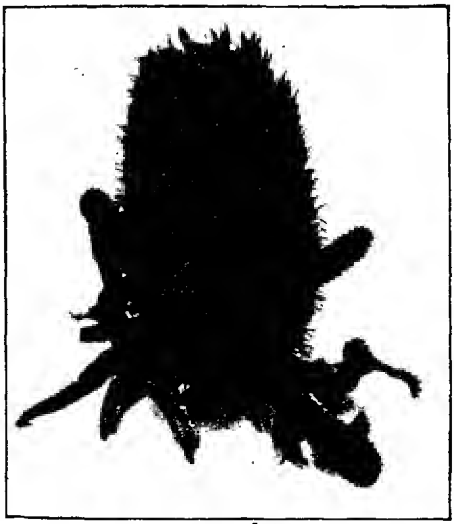


Fig. 60.

after identifying this Banksia from the illustration and description here given, would kindly forward information as to quantity and character of honey produced by this tree, and whether pollen producing or not, so that these details may be included when later the present series of articles are published in book form.

THE DESERT BANKSIA (*Banksia ornata*).

Fig. 60.

A shrub, 5 to 6 feet high, found in the north-west and south-west of Victoria, generally in sandy or desert country, and known to the beekeepers of the western districts as "Banksia," without any distinctive term, the Silver Banksia in a like manner being termed "Honeysuckle."

The Desert Banksia is a rather ornamental shrub, compact in structure, with a deep blue green foliage. The leaves are oblong, wedge-shaped towards the stalk, with regular teeth on the edges, 2 to 4 inches long, ½ to ¾ inches broad, with the transverse veins prominent underneath.

Flower spikes, oblong, egg-shaped, 2 to 4 inches long, or globular. Fruiting cone egg-shaped, seed capsules very thick, and fully ¾ inc broad.

It flowers from April to July, and is a heavy yielder of nectar and pollen, so that brood rearing is kept up in the hives right into winter, insuring successful wintering of the bees, which in part is due to the comparative warmth of the localities where this Banksia grows. The honey,

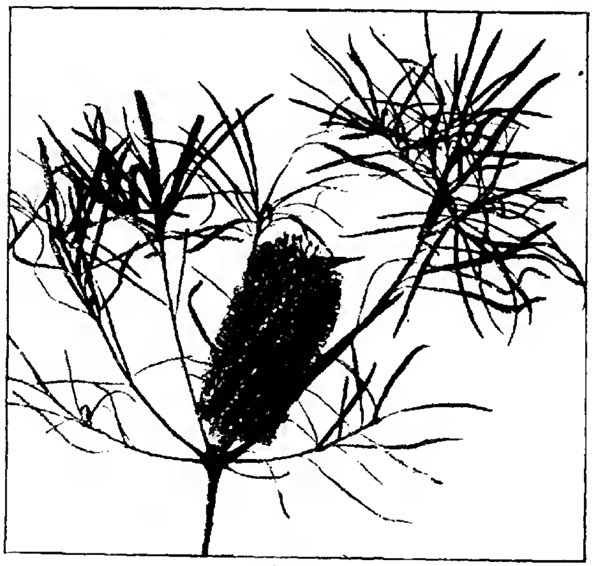


Fig. 61.

like that from the other Banksias, is not first class, candies quickly, sometimes even in the outside combs of the hive, but the Desert Banksia is nevertheless a most valuable bee plant, taking in autumn the place which the Cape weed fills in spring.

THE HILL BANKSIA (*Banksia collina*).

Fig. 61.

A tall, erect shrub attaining a height of 8 to 12 feet, found principally in the south, north-east, and east of the State, and also sometimes known as Hairpin, on account of the wirelike bent back stamens of the flower.

Leaves narrow, linear, $1\frac{1}{2}$ to 3 inches long, more or less toothed, or rarely quite even. Flower spike oblong, cylindrical, 3 to 6 inches long. Fruiting cone cylindrical, seed capsules thick and scarcely protruding.

The Hill Banksia is said to produce nectar so freely at times that it runs down on to the ground. Nothing definite, however, is known on this point, as probably no large apiary has so far been located near a considerable number of this Banksia. Like the Desert Bankisa, it is ornamental, and worthy of cultivation in gardens.

(To be continued.)

THE SUMMER BUD, OR "YEMA" GRAFT OF THE VINE.

By F. de Castella, Government Viticulturist.

To plant a vineyard liable to destruction by phylloxera would be, to say the least, illogical, even in districts into which the insect has not yet found its way. It is already firmly established in several widely separated portions of the State, and the time will inevitably come when the whole of Victoria will be infested. In already phylloxerated areas, the resistant stock is, of course, indispensable, and the plantation of vines with vulnerable roots is quite out of the question.

A vineyard on resistant stocks may be established in two ways:—

1. Plantation of already grafted vines raised in a nursery, or, as they are usually called, "bench grafts."
2. Field graftiug—in other words, the plantation of the vineyard with ungrafted resistant vines or stocks, which will subsequently be grafted to the Europeau or "Vinifera" variety, from which it is desired to obtain fruit.

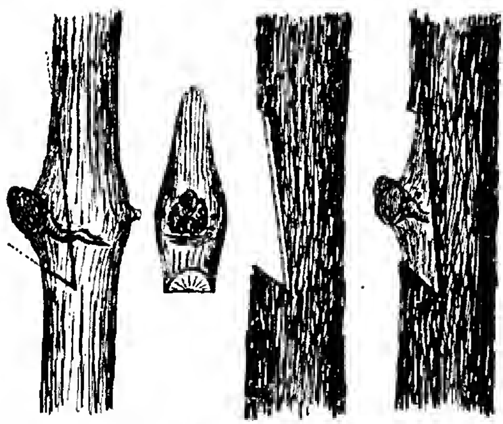
Field grafting, though the older method, has been gradually and very generally superseded in France by the planting of nursery-raised bench grafts, which renders possible the immediate establishment of an absolutely homogeneous vineyard, since it permits the weeding out, when lifting from the nursery, of all faulty grafts; only those being planted in which the union between stock and scion is flawless, thus insuring absolute evenness of the plantation, or what is called in California, "a good stand."

The chief objection to field grafting, especially in the colder climate of northern Europe, is that a completely even stand can rarely be relied upon. Unless the spring be exceptionally favorable for the operation of grafting, gaps occur where vines have failed, as well as a certain proportion of faulty grafts which scarcely ever develop into thrifty vines. In our warmer Australian climate, weather conditions in spring are more favorable for grafting, and except in such an unusual season as the present one, results are generally far more satisfactory. Our climate is more similar to that of Spain and Portugal, where field grafting is held in higher esteem than in France. Nevertheless, even with us, anything which can insure a higher percentage of perfect unions will be a distinct boon to those reconstituting by means of field grafting, and the graft about to be described undoubtedly contributes to this result, both by the perfection of the union, and by the second chance it provides, of re-grafting the following spring, any of the summer grafts which have failed, or which are unsatisfactory.

The Yema Graft in Spain.

"Yema" means, in Spanish, a bud or eye—the germ of anything in fact, since it also signifies the yolk of an egg. It is the name generally given to this graft in southern Spain. Though often referred to as "budding" in northern Victoria, the operation is distinct from budding in the usual sense of the term, and as currently practised on citrus, roses, &c. It is a real graft—a summer bud graft—for the wood of the vine is rather deeply cut into, and the woody core of the scion-bud is not removed as is usual in ordinary budding. The main differences to be found between it and ordinary grafting are the season when it is carried out, and the very small dimensions to which the scion is reduced. Like ordinary grafting, it is performed on the portion of the stock beneath the surface of the soil.* Budding is practised above ground, and usually on green herbaceous canes.

It was at Jerez de la Frontera, in Southern Spain, the home of sherry, that the writer first made the acquaintance of this graft which, since its introduction into Victoria, has been so successful that it bids fair to become the favorite field grafting method. On his return to Victoria, the Spanish graft was described in this journal in the issue of June, 1908. This description is here reproduced. It will be followed by some further details in the light of practical experience gained since its introduction into Victoria.



A B C D

Fig 1.

A and B. Removal of bud for *Yema* graft.
C. Stock ready to receive bud of *Yema* graft.
D. *Yema* graft completed and ready for binding with raffia.

The other method is known as *Yema*. It is a summer bud graft and was quite new to me both as regards method and season for execution. It is a true

* Though the graft is made two or three inches above the surface level it is invariably covered by a protecting mound of earth, so that, during the knitting period, it is several inches below the surface of the mound. (See Fig. 3.)

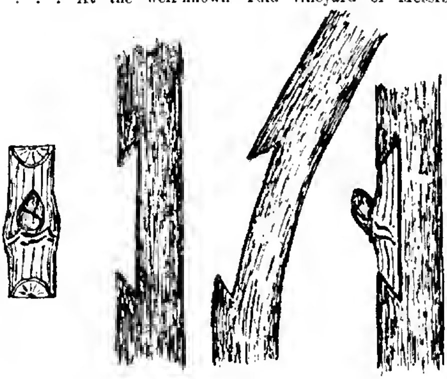
graft and not a form of budding in the sense in which we usually understand it, for the bud is removed together with a fair sized fragment of the already woody shoot of the current year's growth. The stock is prepared to receive it by the removal of a similar shaped piece of wood by means of four cuts of the grafting knife; into the gap thus made, which reaches nearly to the centre of the cane,* the properly cut eye is carefully fitted and securely bound with raffia. Care must be taken in fitting the bud into its place that the cambium layers of stock and scion correspond as accurately as possible. When tying, the raffia must first be placed over the bud and bound round and below it so as to insure thorough contact at the base of the graft.

This graft is best suited for cases where there is but slight difference in diameter between stock and scion, as in the case when a one or two year old rooted vine is grafted in the vineyard. *The upper part of the stock is not cut off but continues its growth,* the flow of sap which is thus maintained enables the union to take place under most favorable conditions. The graft knits but *the bud remains dormant* until the following spring when, after the upper part of the stock has been cut back, it makes very vigorous growth.

August is the best month for the execution of this graft in Spain. This corresponds to February in Victoria; a convenient time, falling, as it does, between harvest and vintage. As soon as the young shoots of the current year are sufficiently lignified to provide a properly ripened bud the operation may be performed. The bud is grafted on, at about the level of the ground which is then heaped up around it into a high mound to protect it from changes of temperature and desiccation. (See Fig. 3.)

This graft practically gives the vigneron "two strings to his bow." When the time for ordinary spring grafting comes round it is possible to see if the bud has taken or if it is dead; in the latter case the stock is cut off half an inch below the bud graft which has failed and re-grafted in the ordinary way.

The unions obtained by means of this graft in southern Spain are really magnificent. . . . At the well-known Tula vineyard of Messrs. Gonzalez,



A B C D

Fig. 2.—The Spanish "Yema" graft—second style.

A. the scion bud; B. incision in stock; C, same, bent to facilitate insertion of scion; D, graft completed and ready for tying.

Byass, and Coy., this style of grafting is in great favour. "*Espiga ne vale nada*" (The *espiga*† graft is no good) said the *Capataz* (overseer) of Tula to me. He assured me that with the *Yema* a larger percentage succeeded and that the unions

* According to later experience this would be too deep, as will be seen later.
† Espiga is the Spanish name for the ordinary cleft graft.

were more perfect. I have collected full information concerning this interesting graft and feel sure that it is at least worth a careful trial in the warmer parts of Victoria where climatic conditions are so similar to those of Andalucia, and where the perfect union it gives will no doubt render it popular.

In Spain, the graft is performed in two distinct ways. In addition to that illustrated in Fig. 1. it is sometimes executed as shown in Fig. 2. As will be seen, the fragment of cane which constitutes the scion is of practically the same thickness throughout. The socket or incision into which it will be fitted on the stock is also of different shape, being cut at the same angle above and below. It might be called a dovetail graft.

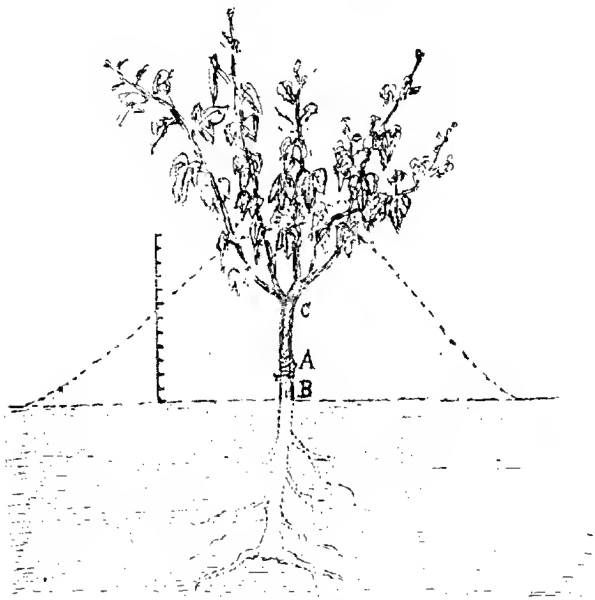


Fig. 3.—Young resistant vine in February, six months after plantation as an "ungrafted rootling."

The Yema graft has just been inserted at A, and protected by a mound of loose soil about 12 inches high—scale of inches to the left.

When fitting the scion, the stock can conveniently be bent, as shown at C, Fig. 2, thus slightly elongating the socket, and facilitating the insertion of the scion, which is firmly held in place on the stock being allowed to straighten out again. A very neat graft can thus be executed, provided the scion has been judiciously chosen as to size, and it, as well as the stock, accurately and cleanly cut. It is, perhaps, a little more difficult than the first method, for which reason it was not described in the report quoted from above.

A general idea of the graft may be formed from Fig. 3, which shows a young resistant vine, planted as an ungrafted rootling in, say, August, 1915; the scion bud having been grafted in at "A" in February, 1916. As will be seen, immediately after grafting, the whole stem of the vine is mounded up with loose soil; the height of the mound is usually about 1 foot, the base of the young canes, and a good many leaves, being often covered with soil. It will be noted that the top of the stock is not cut off at the time of grafting*, but is allowed to continue its growth. This is, no doubt, one of the factors contributing to the excellence of the unions; the sap circulating freely in the tissues immediately adjacent to the graft, callusing is very thorough and complete.

Towards the end of winter, the mound should be removed; it is, in fact, usually broken down before this by the ordinary cultural operations. It is then possible to see if the graft has succeeded, in which case the bud will be found to be large and healthy, and firmly united to the stock by the callus which has formed. If the graft has failed, the scion bud, now considerably shrivelled, can easily be rubbed out with the finger. If the graft has satisfactorily taken, the stock is now cut off with the secateur at "C," Fig. 3. On no account should it be cut any closer to the bud, as the stock would be liable to die back on the opposite side to the bud. A stub or butt of the old stock 5 or 6 inches long should be left above the graft, which will be finally removed a year later. Should the graft have failed, the vine is allowed to remain until September or October (in Victoria), when it can be cut back at "B," Fig. 3, and cleft grafted in the usual way. The "Yema" graft should be placed about 3 inches above the level of the soil, so that, in case of its failure, the cleft graft will not be so deep as to entail trouble with scion roots.

Similar Grafts in France.

Curiously enough, this graft does not seem to have found its way to France; at least not during the period of active reconstitution (1885-99), during which French ingenuity devised an extraordinary number of new methods for budding and grafting the vine. It is not described in "Grafting and Budding,"† though the grafts of Besson, Massabie, and of Clarac (No. 2) present some points in common with it. These, however, are buds rather than grafts. The form of grafting which most resembles it, especially as regards the season for its execution, is the well-known Cadillac graft—a side cleft summer graft which will be described later.

A graft was, however, described in the *Progres Agricole*, of 25th February, 1912, by M. J. B. Maïs, which is practically identical with the Spanish Yema, second style‡, as will be seen by reference to Fig. 4

The following extracts from Mr. Maïs' article will, no doubt, prove of interest:—

Stocks (ungrafted) should be planted from December to March (June to September in Australia). As soon as the shoots are about an inch long a bud is placed, as shown in Fig. 4 (scion A, stock B) and tied with raffia.

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* According to M. Maïs, severe topping is recommended immediately after grafting (see page 46). This is not usually done in Victoria. If the vine has not made very strong growth, it is probably better not to top, though in the case of very vigorous vines it might be an improvement; it would, at any rate, reduce the power of the wind, which, on a very strong vine, tends to break down the mound.

† New Methods of Grafting and Budding, as applied to Reconstitution with American Vines, by Dubois and Wilkinson—published by this Department in 1901.

‡ J. B. Maïs, President, Syndicat Agricole of Lectoure (Gers), France, in *Progres Agricole*, Montpellier, 25th February, 1912.

One-third of the thickness of the stock is removed, and in its place is fitted one-third of the scion cane bearing a bud. This bud rots and makes way for two or three smaller buds which develop around it, sending out canes of three and four yards long the following season.

After the 10th August (February in Australia) the work may be continued, the buds being taken from the current season's canes. After the 10th September (March in Australia) cold rains are likely to render results uncertain. During the currency of the whole summer it is difficult, a month after grafting, to tell that there has been a graft at all so perfect is the union. Needless to say, scions for grafting until July should be preserved in nearly dry sand and in the dark if possible. Should the first graft fail, another can be placed in position in August (February in Australia) about an inch below it. Should this fail also, the ordinary cleft graft can still be practised the following spring, thus assuring thorough success throughout the whole vineyard.

The vigor of plantations thus established is much superior to those planted with grafted rootlings up to the fifth year; afterwards, the difference is less noticeable. This enhanced vigor is explained, first, by the suppression, so to

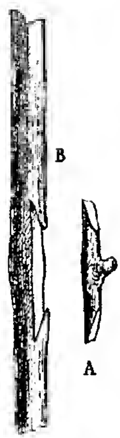

Fig. 4.—Graft similar to "Yema," recommended by M. J. B. Maïs.

speak, of the graft (the union being so perfect), and second, by the fact that when wild vines (ungrafted resistant rootlings) are planted they have often ten or fifteen roots, whereas with grafted rootlings there are sometimes only one or two; furthermore, by leaving the wild vine to itself during the whole of the first season, it grows much more than its grafted neighbour, and as a result its roots penetrate more deeply and develop more vigorously, thus stimulating the growth of the scion much more during the second year.

If grafted in August-September (February-March here) all the canes of the stock should be severely topped in order to give a check to the sap, such as will bring about a rapid union (*soudure*).

One man can easily do 350 to 400 grafts a day. The scions should be cut beforehand and kept fresh in a piece of wet bag; in order to make rapid progress, it is necessary to have a choice of scions, owing to the difference in diameter of the stocks.

In spring it is well to drive in a small stake to each vine; owing to their vigor, the wind might break them out, thus causing blanks.

Fig. 4 is reproduced from Mr. Maïs' article.

The Graft in Victoria.

From the description first reproduced above, and acting on verbal advice, several Rutherglen growers tried the graft. Mr. P. A. Wyatt, at that time Travelling Viticultural Assistant of this Department, demonstrated it to numerous growers, with the result that a good many vines were thus grafted in February, 1909. The encouraging results of these first trials led to their renewal on an increasing scale each season with greater success. As was to be expected, each grafter applied such modifications and improvements as practical experience suggested to him, until a method was evolved, differing somewhat from either of those already described, and which is now very generally followed throughout the district.

Simultaneously with this the graft was being extensively practised at Mildura, with most encouraging results. To Mr. J. Rounce, now an officer of the New South Wales Agricultural Department, belongs the credit of its success in this district. He had experience of this graft in England before coming to Australia, as he informed the writer after a lecture delivered in 1908, at which the graft, as practised in Spain, was described and illustrated. He had seen it applied to roses and several other garden plants. Mr. Rounce practised it on the vine with remarkably successful results, and within the past few years he has reconstituted considerable areas on resistant stocks by this method. The manner in which he executes the graft differs a good deal from that which has become so popular at Rutherglen, as will be seen presently.

The "Yema" graft is, in fact, remarkably elastic; it permits of a good deal of variation, according to the individual fancy of the grafter. The two methods about to be described and figured do not pretend to exhaust all the possibilities. The graft may yet be varied in other details.

As to which is the better of the two, it would be rash to attempt a definite statement. The writer has known percentages of 98 and 99 of completely successful unions by both methods. Both methods seem to give equally perfect unions. So far as the final result, there would seem to be little difference between the two, though Mr. Rounce's modification, permitting, as will be seen, the suppression of tying or binding the graft, should enable the grafter to operate more rapidly. These two typical modes of executing the graft will now be described in detail. Afterwards, a few points of importance in connexion with summer grafts in general, irrespective of the style of graft, will be considered.

The Rutherglen Method.

This is illustrated in Fig. 5, which shows how the scion-bud is removed from the cane, and Fig. 6, where the preparation of the stock, the fitting in of the scion bud, and the binding necessary to hold it in position, until knitted, are shown.

A suitable bud must first be selected. It should be situated on a cane of somewhat smaller diameter than the stock on which it is to be grafted. It must also fulfil the conditions specified under the heading "scion requirements." The scion-bud is removed, as shown in Fig. 5. An oblique cut, penetrating to about the middle of the cane, and rather

more than half-an-inch below the bud, is first made (a, Fig. 5). Commencing at b, a curved cut is then made as shown by the dotted line (Fig. 5), which, junctioning with the first cut, removes the scion bud. This cut should be fairly deep, so that, after removal, the piece bearing the bud shows the pith along the whole section. It is now rather thicker than is desirable, and requires paring down on the inner, or wood side, and shortening by the cut shown at c (Fig. 5), which is made at a more acute angle with the axis of the cane than that at "a." The paring should be carefully done, so that the bud-scion, when finished, is cut to an absolutely plane surface, only showing two small spots of pith on the inner or wood, side above and below the transverse woody partition, which is to be found at every bud. The section should appear as shown (Fig. 5), C.

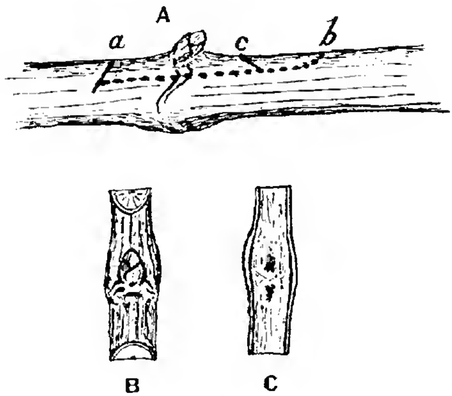

Fig. 5.

A, removal of scion bud as practised at Rutherglen; B, outer view of bud immediately after removal; C, view of same from inner (wood) side, after trimming and when ready for insertion in stock.

Fig. 6 shows how the stock is prepared. Four cuts of the budding knife are required; A shows the stock after the first two have been executed, and B after completion of the whole four. The stock is now ready to receive the scion.

The first cut should be exactly similar to that made at a (Fig. 5), when taking the scion. It is essential for an accurate fit that this cut should be made at the same angle, both on stock and scion; a way of insuring this is by cutting the scion, in the first place, a little longer (below the bud) than is really required. By holding it against the uncut stock in as nearly as possible the position it will ultimately occupy, it is easy, by a single cut of the budding knife, through the base of the scion-bud, and into the stock to the required depth, to obtain absolute identity of angle.

The remaining three cuts will be readily understood on reference to B (Fig. 6). It will be noted that cut No. 4 is continued for about a third of an inch, after junctioning with No. 3, so as to provide a sort of flap, under which the sharply bevelled apex or toe of the scion can be pushed whilst the heel is made to fit neatly in the niche or cavity prepared for it. The scion-bud, definitely placed in position, is shown in C (Fig. 6). A fifth cut can usually be made with advantage at *c* (Fig. 6), slightly shortening the flap which covers the toe of the scion-bud. This very small cut is made obliquely, but in reverse sense to that which completed the scion-bud *c* (Fig. 5), and in such a way that the section of the cambium layer which it exposes is as near as possible to that made by the third cut in the lifting of the scion *c* (Fig. 5). Though

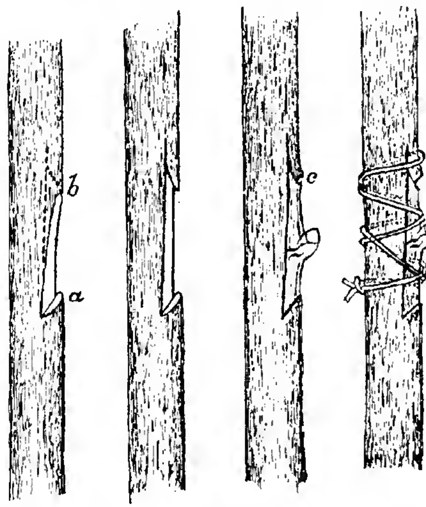

Fig. 6.—The Rutherglen method.

A and B shows the four cuts which prepare the incision in the stock; C, scion bud placed in position; D, method of tying.

these two cambium sections are not in absolute contact (as all the others should be), only a very small interval separates them. They are close enough for this small gap to be easily bridged over by callus, the formation of which is remarkably active under the very suitable conditions of warmth, moisture, and aeration prevailing in the interior of the mound.

The scion bud should be of such a size that the cambium sections of stock and scion coincide in the greatest measure possible. The more completely this condition is realized, the better the chance of the graft taking. On no account should the scion be too large—overlapping is fatal to success, the rapid formation of callus tending to lift the scion-bud out of its proper position. If any departure from an accurate fit is

permissible, the scion should be too small rather than too large; callus then forms outside and not inside the graft, holding the bud in, instead of forcing it out. An exact fit, however, is the ideal which should be aimed at. Another reason for avoiding too large a bud is that there is a tendency for the scion to be slightly flattened out by the pressure of the string used in tying; this may cause one, or even both sides of a large bud to overlap, with the undesirable result just described.

In a trellised vineyard, the bud should be placed in the direction of the wire, and not perpendicularly to it, which would result in the young vine growing out of the line the following spring. The bud should also be placed, as far as is possible, on the lee side of the stock as regards winds likely to cause damage in spring.

The graft having been properly fitted, it must be tied, so that stock and scion will be held firmly in position until knitted. Tying is indispensable in the case of the Rutherglen form of graft, with its rather long and thin scion-bud. Tying may be done in various ways—that shown at "D" (Fig. 6), is perhaps the most convenient. Bagging twine, preferably split up, so that two or three strands are used, instead of the whole twine, is a convenient tie. It is better than raffia, which, being flat, interferes rather more with callus formation. A common mistake with beginner is to plaster the graft with raffia, string, or other substances. The tie is really only needed to keep cut surfaces in contact until knitted—otherwise it hinders rather than promotes the formation of callus. Protection by waxing, &c., is no doubt necessary in the case of an apple, which is grafted above ground; not so with the vine, which is usually grafted underground. The mound of loose earth (Fig. 3) provides ample protection against drying out of the scion.

Opinions differ somewhat as to the best length to give the scion-bud — that shown in Figs. 5 and 6 is the most usual. Some experienced grafters favour a lesser length, their advice being to make the graft as short as is conveniently practicable.

Mr. Rounce's Modification.

This method, which has been so successful in the Mildura district, will be readily understood on reference to Fig. 7. The scion-bud is removed in practically the same manner as is shown in Fig. 1, two cuts sufficing—the first is exactly similar to the corresponding one in the Rutherglen graft. When making the second cut, an oscillatory movement should be given to the knife so as to cut without splitting when passing through the twisted fibres underlying the bud. If skilfully removed, the section will be a plane surface, and the scion-bud ready for immediate insertion in the cavity prepared to receive it, without any paring or trimming.

In preparing the stock, three cuts are all that are needed. The cavity is somewhat similar to that made in the last graft, but deeper. The graft is, in fact, very similar to the Spanish Yema, as shown in Fig. 1., but deeper and shorter. If neatly executed, and with scions thoroughly suited to the size of the stock, the buds are so firmly held that no tie is necessary. The operation of grafting is thus considerably simplified, both by the suppression of several cuts, and by enabling tying to be dispensed with, so that a greater number of vines can be grafted in a given time than by the graft previously described. As regards the

perfection of the unions, there does not seem to be much to choose between the two methods; with both they are remarkably perfect.

Stock Requirements.

When planting the vines, care should be taken to see that there is a straight portion of stem where the bud can conveniently be inserted, about 2 or 3 inches above the level of the soil. The most convenient size is when the diameter of the stock is about half-an-inch. When larger, the operation is less convenient. Smaller

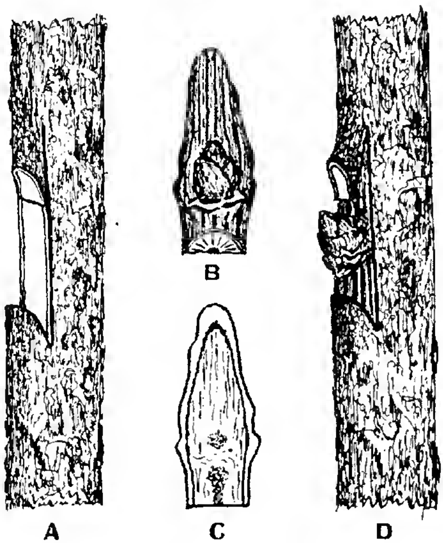

Fig. 7.—Mr. Rounce's modification.

A, preparation of stock; B, outer view of scion bud; C, inner view of same; D, the completed graft.

stocks can, however, be successfully grafted. One very successful grafter remarked to the writer that he was not afraid how small the stock was provided he could find scion-buds small enough. Vines planted in August are usually fit for grafting the following February, save in an exceptionally dry season.

In order to insure success, the stock must be well in sap. In other words, it must have plenty of life in it. Should there be a good fall of rain during January, conditions are usually ideal for this graft during the month of February, but even in the absence of summer rain, with vines planted on properly prepared land, and adequately cultivated during spring and early summer, there will be plenty of sap for success.

Scion Requirements.

As has been shown, the scion should be taken from a cane of rather smaller diameter than the stock on which it is to be grafted. The question arises whether lateral shoots are eligible as scions, or whether main canes only should be used. Seeing that laterals are ready quite as capable of producing fruit as main canes,* there should be no objection to their use, provided they are well constituted and not too pithy. Needless to say, the same rigorous care is necessary in the selection of the scion buds as in the case of scions for ordinary spring grafting. They should in the first place be only taken from vines picked on account of the quality and quantity of the fruit they yield†. In the second place, only fruit-producing canes must be used; water shoots and suckers should on no account be employed. Of course, laterals must only be those growing on fruit-bearing canes; any others are useless.

Buds should only be taken from canes which are properly ripened, the green or yellow colouration having changed to brown; unripe buds are, it is true, capable of uniting, but they are not nearly so sure; with them one cannot rely upon a high percentage of success. Buds should be free from laterals; in practice it is often found that a bud which has failed, or has taken in an unsatisfactory manner, shows the fragment of a small lateral alongside of it, which was cut back at the time of grafting. Where the Yema graft is to be practised on a large scale, it would be well to prepare the canes to be used as scions by breaking out the laterals in November-December, when they are still quite small and easily suppressed. Well-developed laterals are less liable to have secondary laterals in the axil of the leaf, for which reason they are very convenient to use. If the main canes of the vines used as scion bearers are stopped early in November, stout laterals will be thrown out, which will be well ripened by February.

Needless to say every precaution must be taken to avoid drying out of the scion canes. The season best suited for this graft being the hottest time of the year, only a few hours' requirements should be cut at a time, and these should be rolled in a piece of wet bag; they should not, however, be cut into short lengths and kept floating in a bucket of water as is sometimes done.

The graft is, in fact, more practical if scions are obtainable in the same vineyard where they are to be grafted than if they have to be brought a distance; in the latter case they must be packed in such a way as to guard against desiccation in transit, and before use the canes should be placed for a day with their butt ends in clean water.

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* As regards fruitfulness of lateral canes, see article on "Pruning the Ohanez and some other Vines" (*Journal*, 10th August, 1915, page 468.)

† One great advantage of this graft is that scion selection need only be made at the actual time of grafting; the fruit being then on the vine and approaching maturity, it is easy to see which are the most prolific vines. In the case of Spring grafting, the scion bearing vine must be marked six months beforehand—work which is too often overlooked.

(To be continued.)

AGRICULTURAL ITEMS.

It is a good deal easier to condemn a new idea than it is to comprehend it.

The old adage, an ounce of prevention is worth a pound of cure, is doubly true in the breeding business.

The Chinese get hold of excellent ideas. They have an "order of the excellent crop," the blue ribbon of Chinese agriculturists.

During the coming winter farmers should take great care of the farmyard manure, and not allow its valuable constituents to drain away.

Do not attempt to fatten pigs while they are running at large all over the farm. To finish them properly they must be confined in a relatively small pen or yard.

The milk last drawn from an animal is always much richer than that drawn first. This statement only applies to the fat: the other solids remain fairly constant all through.

As a general rule it is poor policy to raise a puny, under-sized calf for dairy and breeding purposes. Only the best calves from the best milking families should be kept.

What the Empire is asking for just now, and she never had greater need to ask, is that every individual should do his bit. Farmers are contributing their share, and will continue to do so.

Care should be taken during the winter months to supply the pigs with an abundance of green feed of some kind. Pumpkins, mangels, or sugar beets, pulped, are about the best available on the average farm.

The meal of cocoanuts after the oil is extracted is being used in England for feeding cattle with good results. It is said that these nuts can be produced so cheaply that this meal may actually compete with other feeds.

MILLING AND BAKING TESTS OF F.A.Q. STANDARD WHEATS FOR SEASON 1916.

By P. Rankin Scott, Chemist for Agriculture, and F. G. B. Winslow, Miller.

This State, in common with other wheat-growing States in the Commonwealth of Australia, has generally a surplus of wheat for export. As this surplus wheat is the product of a number of varieties grown under different soil and climatic conditions, a standard of quality to regulate the sale of this wheat is necessary. The F.A.Q. standard wheat is the representative average of the wheats grown in each State. This standard is yearly struck by the corn section of the Chamber of Commerce in this State; a somewhat similar method being adopted in the other States. By determining the milling and baking qualities of the standard wheats it is possible to glean information of some value which can be used to compare the qualities exhibited by individual varieties of wheat. With this end in view, samples of the F.A.Q. wheats, representative of New South Wales, South Australia, Western Australia, and Victoria have been tested. Before proceeding with an analysis of the results of the tests applied, it may be opportune to make some casual reference to wheat growing in this State. Although the wheat-growing industry is gradually expanding, through the opening

up and development of virgin country, the employment of superphosphates, better methods of cultivation to conserve soil moisture, &c., it is still capable of returning heavier yields per acre, and better quality wheat. Illustrative of the production of wheat in the four States mentioned it has been computed that, for last season, the yield exceeded 160,000,000 bushels, the amount required for local use not exceeding 36,000,000 bushels, we have a balance of 124,000,000 bushels to export, this State contributing a yield of 58,200,000 bushels. For the purpose of comparing the milling and baking qualities of the wheats they were submitted to the following tests:—

1st. Determination of the amount of foreign matter present, and the respective amount of each material.

2nd. Determination of the percentage of the different grades of wheat grains.

3rd. The milling, including some of the ordinary chemical tests.

4th. The baking test.

The Foreign Matter.

The amount of foreign matter in wheat is a matter of importance to both the miller and to the exporter. From a miller's point the quality of the wheat depends largely on the percentage of impurities, the moisture, and the strength. The exporter is concerned in handling and paying extra freight for the impurities which are useless to the miller.

Table I.—Showing Amount of Foreign Matter and Relative Percentage of Each Ingredient.

(1,000 grams taken).

—	Barley.	Chaff.	Drake.	Oats.	Rubbish.	Smut.	Stem.	Whiteheads.	Wild Oats.	Weed Seeds.	Per cent
New South Wales ..	0·23	1·77	0·01	0·75	0·40	0·69	0·33	0·73	1·11	0·02	0·60
South Australia	12·79	1·97	0·52	0·12	0·39	0·31	0·04	0·82	0·19	0·05	1·72
Western Australia ..	2·32	3·62	1·26	0·59	0·57	0·04	0·08	1·27	..	0·05	0·98
Victoria	4·72	2·32	0·76	0·47	0·47	0·76	0·29	2·64	1·46	0·24	1·41

Comparing the results obtained from the wheats one or two notable features become evident, for example, the percentage of foreign matter is very variable, ranging from that of South Australia 1.72 per cent. to that of New South Wales .60 per cent.—the high percentage found in the South Australian wheat being largely due to barley grain. Our Victorian wheat contains a high percentage of whiteheads. The New South Wales wheat is practically free from drake, and the Western Australian wheat contains no wild oats. One ingredient common to all, smut, is worthy of special mention; it is a matter of regret that our Australian wheat should contain this fungus, in view of the fact that its ravages can be controlled, and its presence eliminated by the simple process of pickling the seed wheat. While the average percentage of impurities found does not appear large, the number of bushels present in the 124,000,000 bushels for export reaches the respectable total of

approximately 1,460,000 bushels, equivalent to 40,000 tons, for which freight has to be paid.

Table II.—Showing the Percentage of Foreign Matter Found in Previous Tests Compared with this Season Test.

Year—	New South Wales.	South Australia.	West Australia.	Victoria.
1913	0·37	0·77	..	0·74
1914	0·71	0·92	0·61	0·79
1916	0·60	1·72	0·98	1·41

It is to be regretted that the percentage found in the wheat from South Australia and Victoria for this season shows a marked increase above the amounts found in the previous test.

Grading Test.

After the usual preliminary cleaning of the sample to remove the foreign matter, the wheats were graded by means of a set of hand sieves of varying mesh, ranging in size from 3.25 mm. to 2 mm. mesh. By this means it was possible to separate the grains into seven different sizes, with the following result:—

Table III.—Showing Amount of Grain in F.A.Q. Samples Retained on Sieves of Varying Mesh.

(1,000 grams taken).

State.	3·25 Mesh.	3·00 Mesh.	2·75 Mesh.	2·50 Mesh.	2·25 Mesh.	2·00 Mesh.	Screenings.
	grams.	grams.	grams.	grams.	grams.	grams.	grams.
New South Wales ..	24	95·5	430	274	118·5	32	26
South Australia ..	23·5	140	372	241	174·5	28·5	20·5
Western Australia	21	95	204	264	297	77	42
Victoria	14·5	120·5	439	202	146·5	38	39 5

Plate I.

It will be seen on referring to Plate I. that the curves representing the wheats from New South Wales, South Australia, and Victoria agree fairly closely, South Australia showing a lesser amount of large grains compared with the wheats of New South Wales and Victoria. The curve representing the Western Australian wheat is quite distinct, showing a high percentage of small grain. Unseasonable weather during the ripening stage of the wheat may have affected the crops, and in all probability accounts for the poorer development of the grain. The amount of screening, which represents the cracked and shrivelled grain not retained on the 2 mm. mesh sieve, has been reduced when the general average is compared from 4.4 per cent. in the wheats grown during the season 1913-14 to 3.2 per cent. for the wheat grown during

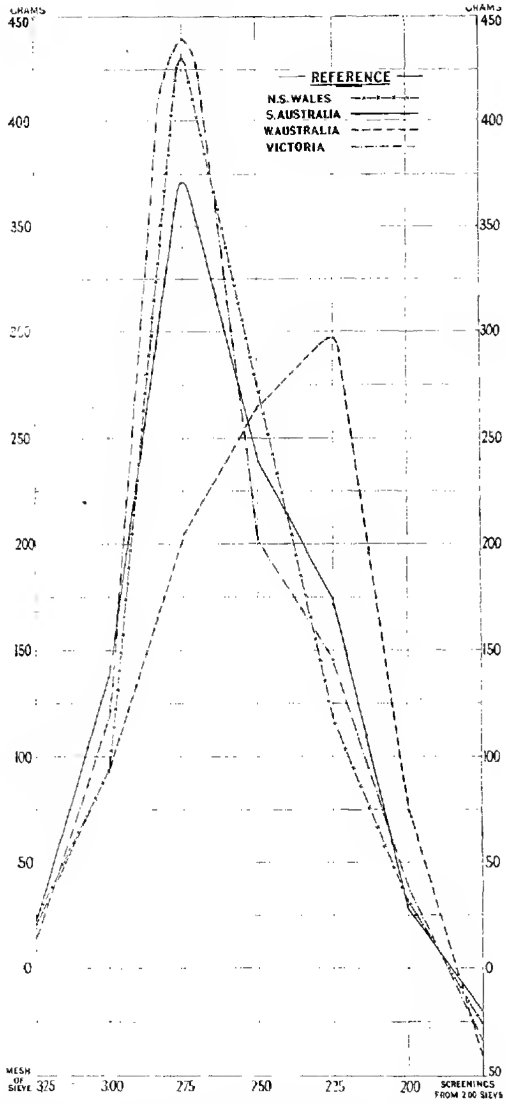

Plate I.

Graph showing Amount of Grain in F.A.Q. Samples (1,000 Grains) Retained by Sieves of Varying Mesh.

the past season, 1915-16. Taking the amount of wheat available for export at 124,000,000 bushels, with an average content of 3.2 per cent. of screenings, the amount of screening exported would represent a figure of approximately 110,000 tons, a comparatively large tonnage of material, which, in ordinary times, is useless for milling purposes, but for which the same freight charges would be made. By eliminations of the screenings from the export wheat, not only would a considerable saving be made on freight payable, but the quality of the wheat would be increased, and the screenings kept in the different States and utilized for feeding poultry, pigs, &c.

TABLE IV.—SHOWING PERCENTAGE OF FIRST GRADE GRAIN (RETAINED BY 2.75 MM. SIEVE) COMPARED WITH PREVIOUS TESTS.

—	1912.	1913.	1915.
New South Wales	62·2	60·1	54·9
South Australia	59·5	43·0	53·5
Western Australia	..	56·6	32·0
Victoria	70·8	54·8	57·5

From season to season variations are apparent in the size of the grain composing the bulk sample. These variations are no doubt due, in a large measure, to variations in conditions existing during the growing period. To obtain well-matured wheat, bright, warm weather, sunshine, and a fair supply of moisture in the soil are conditions favouring well-developed grain.

TABLE V.—SHOWING MILLING AND CHEMICAL TESTS.

Sample No.	State	Dirty Bushel Weight.	Clean Bushel Weight.	Water used in Conditioning.	Break Flour.	Flour.	Bran.	Pollard.	Colour.	Strength.	Wet Gluten.	Dry Gluten.	Remarks.
		lbs.	lbs.	c.c. m. %	%	%	%	%	20 Points Max.	Quart Water. 200 lbs. Flour.	%	%	
[illegible]	New South Wales	61	63·5	3·0	7·05	65·5	18·5	12·0	16	47	25·8	8·6	Grain, medium size, soft dull colour; bran, broad, thick; flour, soft, good bloom
[illegible]	South Australia	62·5	65·1	3·0	6·4	71·3	19·4	9·3	15	49	26·5	9·5	Grain, large, bright, larger percentage of semi-translucent grain; bran, broad, fairly thick; flour, soft, very good bloom
[illegible]	Western Australia	60·5	63·4	3·0	5·4	76·2	17·4	12·4	16·6	47·4	21·2	7·3	Grain, bright, medium size, fairly soft; bran, thin, broad; flour, soft, excellent bloom
	Victoria ..	62	65·7	5·0	5·6	76·6	17·2	12·2	15·5	49	23·2	8·04	Grain, excellent, bright appearance; bran, soft, thin; flour, soft, excellent bloom

This test shows the South Australian wheat to be the best milling wheat as regards yield of flour and gluten content. Its water absorption capacity is also good. Among other variations noted, in reference to the other wheats are:—The New South Wales wheat shows a higher

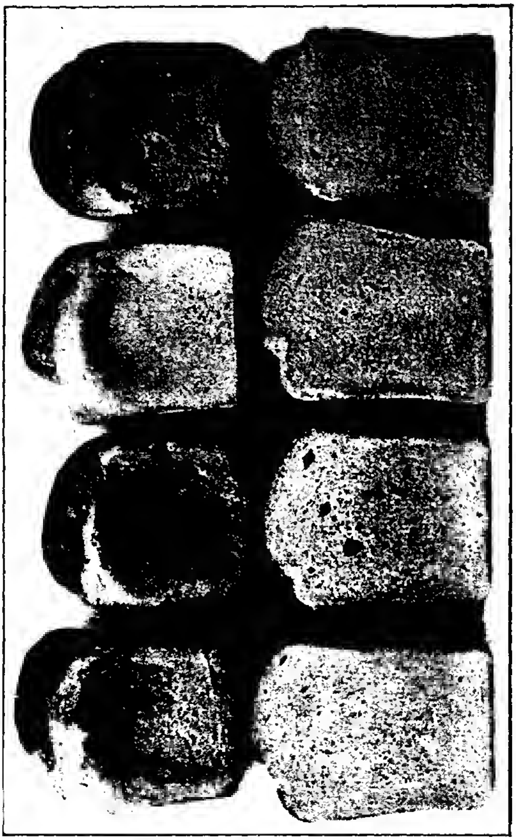

Plate II.

Sets of Loaves.—New South Wales, South Australia, Western Australia, Victoria.

percentage of gluten, but a lower water absorption capacity than that of our own local wheat, it also produced the lowest yield of flour. The Western Australian wheat was poorest in gluten and about mid-way between the New South Wales and Victorian wheat for yield of flour.

TABLE VI.—SHOWING RESULT OF BAKING TEST.

State.	Colour, 20 Points Max.	Texture, 25 Points Max.	Weight of Loaf, Grams.	Volume in c.c.s.	Water absorbed in Doughing, c.c.s.	Points for General Appearance, 20 Points Max.	Remarks.
New South Wales	18	19	475	1,507	199	20	Dough strong, very good rise in oven, good crust
South Australia	18	17	481	1,412	208	19	Dough very strong, fair rise in oven, good coloured crust
Western Australia	18	20	474	1,550	201	17	Dough fairly strong, very good rise in oven, very light coloured crust
Victoria ..	18	20	491	1,555	212	20	Dough very strong, good rise in oven, good crust and general appearance

The result of this test adds support to its value as a means of determining the quality of a flour for baking. On the milling test the South Australian flour showed, if anything, a slight superiority over the other flour. This flour, when submitted to the baking test, gave the smallest volumned loaf; the texture of the crumb being inferior, although the general appearance was fairly good. The Western Australian flour, although showing on the milling tests the lowest percentage of gluten, and a low water absorption capacity, produced a large volumned loaf of good texture, but lacking in general appearance. The New South Wales and Victorian flours both returned fairly large volumned loaves, a good, general appearance, and texture of crumb, the Victorian flour producing a loaf slightly better in texture and volume.

SCIENCE AND INDUSTRY.

At a meeting of the Executive Committee of the Commonwealth Advisory Council of Science and Industry held on the 16th November last, Mr. W. G. Spence, M.P., Vice-President of the Executive Council, presided for the first time. Mr. Spence, after being welcomed by Professor Masson on behalf of the Executive, congratulated the Committee on the work it had so far accomplished, and stated that he was convinced that there were great possibilities in the Commonwealth for research work and for the application of science to industry. The opportunity was taken of Mr. Spence's presence to generally review the work and policy of the Advisory Council, and several matters of importance were brought under the notice of the Chairman. Ten Special Committees have been appointed by the Executive. These are conducting researches into the following matters, viz.:—(1) Chemicals, especially the manufacture in Australia of chemicals hitherto imported and for which we have been largely dependent on supplies from enemy countries. (2) Ferro alloys, the production in Australia of steel suitable for high-speed tools, &c. (3) Standardization of designs of scientific apparatus,

with a view to promoting the manufacture in Australia of satisfactory standard designs of apparatus. (4) Mode of occurrence of gold in quartz, to aid in the localization of payable gold and thus cheapen deep prospecting. (5) Posidonia fibre, the commercial utilization of the immense deposits in Spencer's Gulf. (6) Tick pest in cattle, the loss through which has cost the Commonwealth several millions of pounds sterling. (7) Alunite, the production in Australia of potash salts, the supply of which from Germany has been cut off through the war. (8) Yeasts and breadmaking, in regard to which the results already obtained afforded hope that it will be possible to so shorten the period of the maturing of the dough as to contribute materially to the solution of the "day-baking trouble." (9) The nodule disease in cattle, which like the tick pest has caused enormous losses in Australia; and (10) Marine biological economics of tropical Australia, including the pearl oyster fisheries, the sponge industry, and the beche-de-mer and turtle fisheries. The policy of the Executive Committee in regard to these matters is, after making preliminary inquiries from experts, to refer them for investigation under the general control of Special Committees composed of the highest authorities in Australia, both industrial and scientific. The Special Committees are responsible to the Executive.

Another field of activities of the Executive lies in the matters which have been referred for inquiry to the Committees that have been formed in all the States, those matters including among others—(1) Phosphatic rocks in Australia, with a view to increasing our supply and cheapening the price of phosphatic fertilisers. (2) Grass tree gum, from which picric acid, used in the manufacture of high explosives, can be manufactured. (3) The production of tannin from Australian woods and barks. (4) The production of rennet in Australia for use in cheese making. (5) Wood distillation and the recovery of by-products now being wasted; and (6) An industrial census, showing the stage of development, relative importance and distribution of our industries and the technical and scientific problems affecting them.

The Committee has found it important to keep in close touch, not only with persons directly engaged in our primary and secondary industries, but also with Government Scientific Departments, the Universities and Technical Schools, and among the matters into which inquiries are being made in conjunction with these departments and institutions, the following may be specially mentioned, viz.:—(1) A soil survey of Australia, of great importance in connexion with the settlement on scientific lines of our vast undeveloped areas. (2) The production of cream of tartar, used for the manufacture of baking powders and self-raising flour. (3) Damage done by insects to grain in store, in conjunction with similar inquiries that are being made in England and Canada. (4) The cotton industry in Australia and the introduction of a mechanical cotton picker. (5) The control and eradication of the prickly pear pest which is spreading at the rate of 1,000,000 acres yearly. (6) The production in Australia of casein. (7) Technical Education. (8) The introduction of the metric system of weights and measures and of decimal coinage; and (9) The production of dyes from mangrove bark and from indigenous plants, &c.

A large number of miscellaneous matters have also received the attention of the Committee. Some of these are in the nature of inquiries from manufacturers, and have already been disposed of, while others

are still under consideration. Amongst them, the following are included, viz.:—(1) The sheep blow fly pest. (2) Enamels and glazes. (3) Lanoline. (4) Electrolytic zinc. (5) Forest products. (6) The manufacture of copper sulphate. (7) The production of potash from various sources. (8) Tuberculosis in stock; and (9) Clays and clay products. Complete data are also being collected as to the scientific laboratories available in Australia, their *personnel* and equipment, and the educational facilities for the training of our future supply of scientific investigators. A register is also being compiled of all scientific research work in applied science in progress in the Commonwealth.

Mr. Spence stated that he was impressed by the wide range of the activities of the Advisory Council, and the large amount of preparatory work that had been accomplished, and said that he would bring various matters in connexion with the work of the Council before the Cabinet at an early date. He hoped that before long Mr. Hughes would have time to go fully into the whole matter in the light of the information he had acquired when in England and America, and of the reports presented by the Executive Committee.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Principal, School of Horticulture, Burnley.

The Orchard.

The unseasonable rains of November and December have given orchardists an excellent chance to work up their ground. The soil is now in a very suitable condition for surface cultivation, and the harrows, disc cultivator, or scarifier should be kept going to keep up a good condition of surface looseness. Even where the soil had been previously well cultivated, the cultivators should again be run over the surface, as any hot weather will cause the soil to crust, which would be the means of dissipating a very considerable amount of soil water. Every effort should be taken to retain this moisture, so that the fruit crops shall have all they require for their perfection. To further attain this end, no weeds should be allowed to grow in orchard soils.

Budding.

Young trees, or old trees that have been previously cut down in preparation for budding, may be worked towards the end of the month. It is advisable to select dull, cool weather for this operation, so that the sap may run more freely, and so that the weather will not have too drying an effect on the bud. The operation of budding is a very simple one, and is easily performed. To gain a successful end, the sap should be flowing freely, so that when the cuts are made the bark should "lift" or "run" easily, and without any clinging or tearing of the fibres; and it should separate freely from the wood. The bud selected should be firm and well matured, and should show no signs of premature growth whatever. It is cut from the scion with a shallow cut, and if any wood in the cutting be left in, this should be taken out of the bud. A smooth, clean spot should be selected on the bark of the stock, and a T-shaped cut made, the vertical cut being longer than the horizontal

one. The bark at the point where the cuts meet should be raised, and the bud inserted between the bark and the wood of the stock. The bud should be gently pressed down into position, and it should then be bound with soft twine, string, or raffia. If the bud be too long for the cut, the top may be cut off level with a horizontal cut. With practice, it will soon become possible to take the buds that they will need neither cutting nor trimming.

After two or three weeks the buds may be examined to see if they have "taken," that is, if the bud has united thoroughly to the stock. When that occurs, the tie may be cut. If a growth be desired at once, all wood above the bud may be cut off some short distance above the bud, so as to prevent any bark splitting, and consequent loss of the bud, and so as to throw the bud out at a fair angle. Ultimately this should be properly trimmed.

If desired, the bud may be left dormant throughout the autumn and winter till spring. In this case, the branch is not cut off, but is left on till the usual winter pruning.

SUMMER PRUNING.

The profuse rains of November and December have caused a vigorous growth in the fruit trees. In order to more economically utilize this abundant growth, it should be now summer pruned, particularly on the apple and pear trees. Care should be observed that as much of the leafage as possible is retained on the tree. Unduly long laterals of fruiting trees may be shortened back, always cutting to a leaf. Unnecessary terminal leader growths, of which there are sometimes three or four, all strong growing, may be reduced to one, retaining this one as a leader. In no case should this growth be cut or interfered with in any way.

The results of these cuts will be to divert the sap which was flowing into growths that would subsequently be pruned, into more profitable channels, so that weak buds and growths may be strengthened, and induced into fruit bearing.

Vegetable Garden.

The work in this section is much the same as in the flower garden. Good mulching and regular soil stirring will be the work for the month. As soon as any bed is cleared of vegetables, it should be manured and well dug over in preparation for the next crop. Deep digging is always desirable in vegetable growing. If any pest, such as aphis, or caterpillars, or tomato weevil, have been present, it would be advisable to burn all the crop refuse, or to destroy any insects that remain, and to give the plot a dressing of gypsum, or of Clift's manurial insecticide.

Keep the tomatoes well watered and manured, pinching out surplus and strong grown laterals. In early districts the onion crop will be ripening. In late districts, or with late crops, the ripening may be hastened by breaking down the top. An autumn crop of potatoes may be planted. Cabbage, cauliflower, lettuce, and celery plants may be planted out.

Flower Garden.

January should be a busy month in the garden. It may be necessary to water constantly and frequently, and after every watering the surface should be well loosened, and stirred with the hoe to keep it moist

and cool. More cultivation and less water is a good rule to be observed. The hoe should be used more, and the hose less in summer; greater benefits will accrue, and the water bill will be considerably reduced. Mulchings with straw, grass, &c., are very useful just now. The mowings from lawns form valuable mulching. Waste tobacco stems are also valuable as a mulch.

Dahlias, chrysanthemums, and other tall-growing, slender herbaceous plants will require support in the way of stakes. They will also need mulching considerably. These plants should receive no check whatever, and should be continued with a regular even growth right through the season. Another desideratum is that soils should be well drained, as plants of all descriptions thrive better in well-drained soils.

A sharp look-out should be kept on these plants for attacks of red spider. If this insect appears, a good spraying of tobacco solution or benzole emulsion should be given to the plants.

Constant watch will need to be kept for the various small caterpillars that attack the buds of these plants. Spraying with a weak solution of paris green and lime, or similar insecticide, will be useful. Hand-picking should also be resorted to.

REMINDERS FOR FEBRUARY.

LIVE STOCK.

HORSES: *At grass.*—Supplement dry grass, if possible, with some greenstuff. Provide plenty of pure water and shade shelter. *In stable.*—Supplement hard feed with some greenstuff, carrots, or the like, and give a bran mash once a week at least. Avoid over-stimulating foods, such as maize and barley. Give hard feed in quantities only consistent with work to be performed. Stable should be well ventilated, and kept clean. When at work, give water at short intervals. Always water before feeding.

CATTLE.—Provide succulent feed and plenty of clean water easy of access; also shade and salt lick in trough. Have each cow's milk weighed and tested for butter fat regularly. Rear heifer calves from those that show profitable results. Give milk at blood heat to calves. Keep utensils clean or diarrhœa will result. Do not give too much at a meal for the same reason. Give half-a-cup of limewater per calf per day in the milk. Let them have a good grass run or lucerne, or half-a-pound of crushed oats in a trough. Dehorn all dairy calves except those required for stud or show purposes. Keep bulls away from cows.

PIGS.—Sows about to farrow should be supplied with short bedding in well-ventilated styes. All pigs should be provided with shade and water to wallow in. There will be plenty of cheap feed available now, and there is a good margin between cost of feed and price for fat pigs. Refer to articles on breeding, feeding, &c., in *Journals* of April, 1912, June, 1913, May, 1915. Pigs should be highly profitable animals to feed now.

SHEEP.—Coarse crossbred ewes, known as "three-quarter breeds" or "second cross" are usually in season this month. When grazing sheep, or ewes for future breeding are required good fleeced merino rams should be used with these. Downs breeds of rams where the lambs go for export Should there be among the rams to be used any distinctly inferior to the others, keep them back for twenty-one days, giving the best rams the first three weeks, being sure the ewes are in season. Narrow, inferior rams are almost invariably active, rapid workers compared to sheep of more substance. Keep salt available. Drench any weaners scouring. If necessary to feed do not wait until in-lamb ewes are weak before commencing. When on continuous dry feed sheep move directly off camp to water towards evening each day before feeding. When water becomes inferior, or scarce, and available to in-lamb ewes irregularly, losses with both ewes and lambs before and after lambing appears to be more prevalent.

Avoid moving good woolled sheep unnecessarily in heat and dust of summer.

POULTRY.—Chickens should now be trained to perch; they will be more healthy.

Provide plenty of green feed and give less grain and meat. Avoid condiments. Keep water in cool shady spot and renew three times each day. Keep dust bath damp.

Birds showing symptoms of leg weakness should be given 1 grain of quinine per day (three months old chickens, ½ grain) and plenty of milk.

CULTIVATION.

FARM.—See that haystacks are weatherproof. Cultivate stubble and fallow, and prepare land for winter fodder crops. Get tobacco sheds ready for crop. In districts where February rains are good, sow rye, barley, vetches, and oats for early winter feed.

ORCHARD.—Spray for codlin moth. Search out and destroy all larvæ. Cultivate the surface where necessary and irrigate where necessary, paying particular attention to young trees. Fumigate evergreen trees for scale. Continue budding.

FLOWER GARDEN.—Cultivate the surface and water thoroughly during hot weather. Summer-prune roses by thinning out the weak wood and cutting back lightly the strong shoots. Thin out and disbud dahlias and chrysanthemums. Layer carnations. Plant a few bulbs for early blooms. Sow seeds of perennial and hardy annual plants.

VEGETABLE GARDEN.—Continue to plant out seedlings from the seed-beds. Sow seeds of cabbage, lettuce, cauliflower, peas, turnip, and French beans. Keep all vacant plots well dug.

VINEYARD.—February is the best month for the "Yema" or Summer bud graft (see article in current issue). Select scion-bearing vines; mark with oil paint those conspicuous for quality and quantity of fruit, regular setting and even maturity.

Sulphur again, if oidium is prevalent, but avoid applying sulphur to wine grapes too short a time before gathering.

Cellars.—Prepare all plant and casks for the coming vintage. An ounce of bisulphite of potash, or a couple of fluid ounces of bisulphite of soda solution, to each bucket of water used to swell press platforms, tubs, &c., will help to keep it sweet. Keep cellars as cool as possible. Complete all manipulations so as to avoid handling older wines during vintage.

SELECTING EWES.

Selecting and keeping the best ewe lambs is the essential factor in success. The reasons for this course are obvious, because no one requires telling that if he sells his best ewes the man who buys them will have better sheep than he. Supposing a farmer having fifty ewes should sell the best ten of them, it will take him some time to breed another ten like them. It is at times rather difficult to resist what seems a tempting bid for a good ewe, but when thinking the offer over it is well to remember that not only do we sell the ewe, but also her possible valuable increase. It is all right to sell some first-class ewes when, as a whole, the flock has been brought up to such a standard of excellence that their removal is not so much noticed, but meanwhile, the safe rule is to keep the best of the best for one's own breeding.

All ewes failing in essential maternal qualities can be profitably dispensed with, for though a ewe may look well and hearty, if she is a bad breeder and poor mother she is no more valuable than a wether, and makes a better showing as mutton than as a member of the breeding flock. Sometimes ewes are kept because they look good and fat, but often their plumpness and good condition are gained at the expense of their lambs—when they have any—and the loss in keeping them is double, because they are keeping better sheep off the farm, and themselves producing starveling lambs, which, if they reach maturity, only serve to perpetuate the faults of their dams.—*Canterbury Times.*

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ANNUAL REPORT ON RESULT OF INSPECTION UNDER THE FERTILIZERS ACT, SEASON 1915-16.

By W. C. Robertson, Supervising Analyst.

The original scheme of inspection of artificial manure stocks and consignments had to be considerably curtailed during the past season. This was mainly due to the depleted nature of the staff.

It is satisfactory to report, however, that a fairly complete inspection was made at consigning stations in the metropolis, and, taking into consideration the fact that fully 90 per cent. per annum of the artificial fertilizers sold in Victoria are sold or forwarded from Melbourne, the analytical results of the samples collected are a safe guide in judging the quality of fertilizer placed at the disposal of the farming community.

Following the custom of previous years, consignments of manure were weighed at the consigning station, the system being to take one bag in every ten, and after computing the resultant weights, striking an average for the whole consignment.

It is satisfactory to report that not one single instance of short weight came under notice. In the matter of superphosphates, the average guaranteed weight per bag was $186\frac{2}{3}$ lbs. net, whilst the average net weight was found to be $188\frac{1}{2}$ lbs. per bag, equalling 1 5-6 lbs. excess weight of superphosphate per bag, or 22 lbs. per ton. This means that farmers buying superphosphate during the season would receive excess weight equivalent in valuo to 10d. per ton.

Whilst on the subject of weight, it is necessary to point out that all manures tend to "dry out" more or less in transit. The greater bulk

of our fertilizers are manufactured in cool weather, and disposed of during the hot months of the year.

Artificial fertilizers may contain up to 12 per cent. moisture when manufactured, and some, as in the case of dried blood, may contain a much greater percentage.

Any material when taken from bulk and divided into smaller parcels will lose moisture, owing to the increased area of surface exposed, and this is specially so when subjected to increased air temperature.

In the case of superphosphate manufactured during the cold season, and afterwards bagged from bulk, and transported or distributed during the hot months of the year, the loss in weight due to the evaporation of water may amount to many pounds per bag.

It must be remembered, however, when buying superphosphate, or any artificial fertilizer for that matter, the object of the purchase is to obtain a certain amount of an essential fertilizing element or elements, as the case may be. This element, or these elements, are in compound form, and, as in the case of superphosphate, may be associated with a "body," "filling," or extraneous matter, and in all cases with more or less water.

Providing the amount of essential fertilizing element or elements bought and paid for remains, and is delivered, the purchaser's demands are met. It does not matter what the loss, so long as it is not that part or portion of the part which is important in plant nutrition.

A close inspection of guaranteed weights at the forwarding end, in conjunction with the sampling and analyses of consignments and stocks, is all that is required, and farmers may rest assured, thanks to the Fertilizers Act, that these matters will receive the attention they deserve.

To illustrate the foregoing remarks more fully, let us assume a farmer buys a bag of superphosphate in the city, weighing 100 lbs. net, and which is guaranteed to contain 20 per cent., or 20 lbs., of phosphoric acid, the latter being the real objective—the essential fertilizing element in its compound form.

The bag of superphosphate is weighed in Melbourne, and an analysis made of the fertilizer. The former shows correct weight, viz., 100 lbs., and the latter 10 per cent. moisture and 20 per cent phosphoric acid.

On arrival at the farm the bag was found to weight 95 lbs., showing a loss of 5 lbs., and the farmer, thinking he has been deprived of this amount of fertilizer, withdraws a sample, and has it analyzed. The result would be 5 per cent. water, and 21.05 per cent. phosphoric acid, showing that although only 95 lbs. of superphosphate has been received, this is actually richer in the fertilizing element, and still contains the 20 lbs. originally purchased, the loss of 5 lbs. in weight being solely due to the evaporation of water.

During the present season a manufacturer was proceeded against for selling an adulterated fertilizer, and, when before the Court, he pleaded, through his solicitor, that the fertilizer when bagged was very wet, and on "drying out" it would have given an analysis equal to the guarantee. Whilst this may have been true, the fact that the fertilizer was being

scaled off at the guaranteed weight did not establish his case, and a penalty was inflicted. In this instance, we have a manufacturer selling water with the fertilizer, and indirectly charging for the water.

During last season some forty samples of the various fertilizers were collected, the majority being obtained at the suburban consigning stations. A casual glance at the appended analytical results will serve to show the manner in which the samples conformed to the requirements of the Fertilizers Act. With the results of analysis, the guarantee of each fertilizer is given, together with details as regards the price charged, the calculated value per ton from analysis, and the actual guaranteed value, the latter being computed from the actual label guarantee.

During the season 5 per cent. of the samples collected were found to be adulterated beyond the limits allowed by the Act. This in a normal year would not be deemed satisfactory, but, taking into consideration the grave difficulties with which the farming community are at present contending, one can only remark "more is the pity."

Whilst the manufacturers of simple manures deserve credit for the fair manner in which they treat the farmer, both as regards guarantee and weight, there are some unscrupulous persons who are resorting to "mixing" or "breaking down" in such a manner that the fertilizer, on being placed on the market, has lost all semblance to its original state. Making large profits, these people are content to be prosecuted occasionally, well knowing that the maximum penalty under the Act, viz., £50, can be borne with a smile and without seriously prejudicing the bank balance.

The "breaking down" process is nothing more or less than adulteration, and if a manure cannot be produced in its pure condition at a fair profit, its manufacture should not be undertaken at all.

In the list appended it will be noticed approximately 50 per cent. of the samples collected were taken from consignments or stocks of superphosphates, showing the popularity of this simple fertilizer.

These were being forwarded to all parts of the State, and include consignments to the Riverina.

The following table shows the highly satisfactory manner in which the Victorian farmer has been treated as far as the purchase of this fertilizer is concerned:—

SUPERPHOSPHATES.

Average Guaranteed Analysis. Phosphoric Acid. Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.	Average Analysis of Samples Collected. Phosphoric Acid. Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.	Average Price Charged per Ton.	Average Guaranteed Value per Ton.	Average Value per Ton of Collected Samples.
%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	£ s. d.
17·00	0·63	0·90	18·53	17·70	1·18	1·36	20·24	4 7 6	4 10 9	4 13 9

The average price charged per ton for superphosphate was £4 7s. 6d., and the amount of money distributed gratis by the superphosphate manufacturers to the Victorian producer during the year, in the form of excess phosphoric acid and excess weight, would be, approximately, £35,000.

It should be borne in mind that the average guarantee of superphosphate placed on the market during the past season compares unfavorably with that of the previous year, although the average analysis of the collected samples in 1915-16 is higher than in 1914-15. (See *Journal*, 10th January, 1916.)

Computing average analysis and price from the bone fertilizer (bone) and superphosphate samples collected, the following figures are obtained:—

Bone Fertilizer and Superphosphate.

Average Guaranteed Analysis.					Average Analysis of Samples Collected.					Average Price Charged per Ton.	Average Guaranteed Value per Ton.	Average Value per Ton of Collected Samples.
	Phosphoric Acid.					Phosphoric Acid.						
Nitrogen.	Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.	Nitrogen.	Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.			
%	%	%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	£ s. d.
1·35	9·35	2·42	5·93	17·70	1·45	9·84	4·16	4·63	18·64	**5 11 0**	**4 14 3**	**4 19 0**

A reference to last year's figures (this *Journal*, 10th January, 1916) are particularly interesting in that the average values agree closely, whereas the analyses of the previous year's samples are higher.

Farmers should remember that the unit values for the year, which form the basis of all monetary calculations, are commercial values, and are the actual values placed upon the essential fertilizing elements or compounds by the manufacturers themselves.

The unit values are calculated annually by the Chemist for Agriculture from the figures supplied to him by the manufacturers when registering the brands of the simple manures manufactured or imported by them, and which they intend to sell during the year.

When the farmer asks the manufacturer to mix two or more of these simple fertilizers for him, he must understand that he will be required to pay for the cost of mixing. With the present high cost of labour, this is an item of importance, and, although the manufacturers mix with the aid of machinery, the increased cost of the fertilizer, "bone and super.," which must be placed at the door of the mixing process, is approximately 10s. per ton.

In certain parts of the State farmers reside in close proximity to a bone mill, and they would be well advised in this case if they obtained the bonedust or bone fertilizer from the local mill, and mixed this with a given proportion of superphosphate on the farm.

By doing this the cost of mixing and the freight on the bonedust are saved. On the other hand, the farmer has to supply his own time,

which is usually available between harvesting and sowing, and also the cost of carting the bonedust, but the latter would be infinitesimal if taken as back loading.

Apart from the direct monetary gain, this is a matter of far-reaching importance. From the stand-point of decentralization, the system commends itself. Country bones should be collected and manufactured into bonedust in the various districts, thereby avoiding freight charges. It is not held that all the bonedust and bone manures manufactured in the city are obtained from the raw material collected in country districts, but the total output of some of the mills in the country is annually forwarded to Melbourne, and, after being broken down or used in admixture, is once again returned to the country.

A large amount of the mixture "bone and super." is sold annually, and a very small percentage is manufactured outside the metropolis.

Numerous bone-mills exist in the country districts of Victoria, and these could be increased to the advantage of every one, and would be increased with encouragement from the local farming community.

The following figures show the analyses and values of the samples of "blood, bone, and super.," "dissolved bone and super.," "blood and bone," and "bone fertilizer" collected during the year:—

"Blood, Bone, and Super."

Average Guaranteed Analysis.					Average Analysis of Samples Collected.					Average Price Charged per Ton.	Average Guaranteed Value per Ton.	Average Value per Ton of Collected Samples.
Nitrogen.	Phosphoric Acid.				Nitrogen.	Phosphoric Acid.						
	Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.		Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.			
%	%	%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	£ s. d.
2·50	8·50	1·87	6·62	17·00	2·77	8·15	5·29	5·75	19·20	6 5 0	5 9 6	6 0 2

"Dissolved Bone and Super."

Average Guaranteed Analysis.					Average Analysis of Samples Collected.					Average Price Charged per Ton.	Average Guaranteed Value per Ton.	Average Value per Ton of Collected Samples.
Nitrogen.	Phosphoric Acid.				Nitrogen.	Phosphoric Acid.						
	Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.		Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.			
%	%	%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	£ s. d.
1·00	10·01	3·75	5·10	18·86	1·29	12·73	3·48	2·76	18·98	5 10 0	4 10 8	5 2 3

"BLOOD AND BONE."

Average Guaranteed Analysis.					Average Analysis of Samples Collected					Average Price Charged per Ton.	Average Guaranteed Value per Ton.	Average Value per Ton of Collected Samples.
Nitrogen.	Phosphoric Acid.				Nitrogen.	Phosphoric Acid.						
	Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.		Water Soluble.	Citrate Soluble.	Citrate Insoluble.	Total.			
%	%	%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	£ s. d.
5·87	..	4·27	8·00	12·27	6·14	..	7·33	7·54	14·87	7 1 3	6 17 5	7 11 5

"BONE FERTILIZER."

Average Guaranteed Analysis.				Average Analysis of Collected Samples.				Average Price Charged per Ton.	Average Guaranteed Value per Ton.	Average Value per Ton of Collected Samples.
Nitrogen.	Phosphoric Acid.			Nitrogen.	Phosphoric Acid.					
	Citrate Soluble.	Citrate Insoluble.	Total.		Citrate Soluble.	Citrate Insoluble.	Total.			
%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	£ s. d.
2·81	4·74	12·03	16·77	2·39	6·07	12·86	18·94	5 15 6	4 8 0	4 9 5

As regards bone fertilizer, a reference to last season's figures (see this *Journal*, 10th January, 1916) shows a lower guarantee in phosphoric acid, citrate soluble, but a higher guarantee in nitrogen. The analyses of collected samples in 1914-15 were much higher in the percentage of nitrogen and citrate soluble phosphoric acid. The average price paid per ton for bone fertilizer in 1914-15 was £5 18s. 7d., against £5 15s. 6d. in 1915-16. The average value of collected samples in 1914-15 was £5 8s., whereas this season it is £4 9s. 5d., and the average guaranteed value was £4 15s. 9d. in the former year, as against £4 8s. in 1915-16.

Three samples of special or mixed manures were collected. All were found to analyze up to guarantee. In the case of barley manure, the price charged was £5 10s., the value on analysis £5 8s. 8d., whilst the guaranteed value was £5 6s. 9d. per ton.

In the case of a potato manure, the price charged was **£6 7**s. **6**d., the value on analysis **£7 7s. 1d.**, whilst the guarantee value was **£7** per ton.

The imported special manure, whilst analyzing up to guarantee, shows unsatisfactory values. The price charged per ton being £14 15s., the value calculated on analysis was **£9 11**s. **11**d., and the guaranteed value **£7 12**s. **7**d.

In the case of the single sample of basic phosphate which was collected, the price charged was **£4 5**s., the value on analysis **£3 5**s. **4**d., and the guaranteed value **£3 10**s. **2**d.

This manure is being sold to take the place of "Thomas'" or "Star" phosphate, which prior to the war was imported from Europe.

The basic phosphate on the market is really a mixture of lime and superphosphate.

It should be noted that in all the foregoing calculations the average guaranteed value is to be taken as the value computed from the average guarantee, using the season's unit values.

Prosecutions.

During the season a manufacturer hit upon the happy expedient of mixing large quantities of superphosphate with bone fertilizer, and selling the mixture under the name and price of the latter fertilizer. The registered price of the bone fertilizer manufactured by this manufacturer was £5 15s. per ton. The price of superphosphate in the open market was £4 7s. 6d., so that in adopting the above illegal procedure the manufacturer was, to use a common phrase, "on a good wicket." Fortunately, the fraud was at once detected, proceedings instituted, and a conviction obtained.

In one instance a parcel of manure was sold under two label guarantees.

A country manufacturer has for many years treated the Fertilizers Act with contempt. As far back as 1907 he was fined for non-compliance, yet he still kept on resolutely refusing to obey the law. The fertilizer has been sold annually without an invoice certificate or warranty, and in bags which were not branded or labelled.

Farmers purchasing fertilizer sold in this unsatisfactory and illegal manner were running a grave risk to themselves, whilst at the same time encouraging the manufacturer in wrong-doing.

Finding that repeated warnings had no effect, and after the inspecting officer had been informed by the manufacturer that his only reason for not complying with the Act was due to "pure cussedness" proceedings were again instituted, and a fine imposed.

Early in the season a case came under notice where a farmer purchased a parcel of fertilizer under a well-known old-time name. The fertilizer, when applied to the land, did not give the results anticipated,

and on investigation it was discovered that the fertilizer was not registered. Furthermore, the label and invoice certificate did not agree. Proceedings were instituted, and a conviction obtained.

It is necessary for the vendor to give to the purchaser of any artificial manure in quantity over 56 lbs., at the time of sale or before delivery of any part thereof, an invoice certificate guaranteeing the percentage of fertilizing constituents present in the fertilizer. Several cases of non-compliance with this section of the Act came under notice, and in one instance it was found that the manure sold was of very low grade. Proceedings were instituted, and fines inflicted.

The following table gives particulars of two successful prosecutions this season under the adulterating sections of the Act, viz., 16 and 17:—

Brand of Fertilizer.	Court.	Analysis Guaranteed. Nitrogen.	Analysis Guaranteed. Phosphoric Acid. Citrate Soluble.	Analysis Guaranteed. Phosphoric Acid. Citrate Insoluble.	Analysis Guaranteed. Phosphoric Acid. Total.	Analysis Found. Nitrogen.	Analysis Found. Phosphoric Acid. Citrate Soluble.	Analysis Found. Phosphoric Acid. Citrate Insoluble.	Analysis Found. Phosphoric Acid. Total	Price asked per Ton.	Calculated Value.	Penalty Imposed
		%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	
Magic No. 1 Fertilizer.	Geelong	2·00	3·00	14·00	17 00	1·37	1·50	13·75	15·25	5 5 0	2 15 8	Fine £50, £7 1s. costs,
Elsworth's Bone Fertilizer	Ballarat East	2·50	6·00	11·00	17·00	1·78	*7·35	9·74	17·09	5 15 0	4 10 4	Fine £2, £8 8s. cost

* Including 3.75 per cent. water soluble.

The information in this table speaks for itself, but to the manufacturer intent on adulteration or mixing the penalties are paid without any trouble, for he knows that a few tons of the adulterated article, when sold, will amply compensate the fine.

As an illustration, a manufacturer was fined for adulteration in the years 1909, 1911, 1912, 1913, and 1915. During seven years repeated prosecutions have cost this factory, approximately, £180, and yet the factory works on, apparently earning large profits.

Whilst it is eminently satisfactory to report all simple manures manufactured or imported into the State as being of excellent quality, the fact remains that the tendency to "mix" or "break down" is still in vogue, and the farmer is not reaping any benefit from the process.

Briefly, it may be taken that the breaking down or mixing operation is a mode of procedure by which the percentage profits is largely increased.

Fertilizers Act 1915.

LIST SHOWING RESULTS OF ANALYSIS OF SAMPLES OF ARTIFICIAL FERTILIZERS COLLECTED IN VICTORIA UNDER THE PROVISIONS OF SECTIONS 16 AND 17 OF THE FERTILIZERS ACT 1915. No. 2652.

Label No.	Description of Manure.	Manufacturer or Importer.	Nitrogen.		Phosphoric Acid.								Potash.		Price asked for the Manure per Ton.	Value of the Manure per ton calculated on Result of Analysis.	District in which Sample was Obtained.
					Water Soluble.		Citrate Soluble.		Citrate Insoluble.		Total.						
			Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.			
			%	%	%	%	%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	
903	No. 1 Superphosphate, M.L.	Mt. Lyell M. and R. Co. Ltd.	..	..	20·10	17·00	1·22	1·00	1·73	2·00	23·05	20·00	..	..	4 7 6	5 6 2	Metropolitan
904	Blood and Bone ..	A. H. Hasell ..	7·[illegible]	6·75	..	..	6·06	5·55	5·57	4·00	11·63	9·55	..	..	7 2 6	7 12 11	,,
905	Blood Manure, M.C.C. ..	,, ..	8·72	7·50	..	..	..	..	1·00	1·00	1·00	1·00	..	..	8 10 0	7 9 0	,,
907	Ohlendorff's Dissolved Guano	Gibbs, Bright, and Co.	6·82†	5·50	9·50	7·50	2·11	0·75	0·72	1·83	12·33	10·08	1·00	1·30	14 15 0	9 11 11	,,
908	Blood and Bone Fertilizer, Sickle	Cuming, Smith, and Co. Prop. Ltd.	5·29	5·00	..	..	8·61	3·00	9·51	12·00	15·12	15·00	..	..	7 0 0	7 9 11	,,
909	Bone and Superphosphate No. 1, M.L.	Mt. Lyell M. and R. Co. Ltd.	1·45	1·50	8·45	8·50	4·53	0·50	6·13	9·00	19·11	18·00	..	..	5 12 6	4 15 6	,,
910	Florida Superphosphate, Sickle	Cuming, Smith and Co. Prop. Ltd.	..	..	17·70	17·00	0·83	1·00	1·93	2·00	20·46	20·00	..	..	4 7 6	4 13 1	,,
911	Bone and Superphosphate No. 1, M.L.	Mt. Lyell M. and R. Co. Ltd.	1·46	1·50	7·76	8·50	6·25	5·50	4·49	6·00	18·50	18·00	..	..	5 12 6	4 16 10	,,
912	Bone Fertilizer and Superphosphate (A), Sickle	Cuming, Smith, and Co. Prop. Ltd.	1·90	1·50	10·72	8·50	4·09	3·50	3·63	6·00	18·44	18·00	..	..	5 12 6	5 8 2	,,
913	Superphosphate No. 1 M.L.	Mt. Lyell M. and R. Co. Ltd.	..	..	17·90	17·00	0·79	1·00	1·36	2·00	20·05	20·00	..	..	4 7 6	4 13 10	,,
915	Florida Superphosphate, Sickle	Cuming, Smith, and Co. Prop. Ltd.	..	..	17·76	17·00	1·55	0·50	1·10	0·50	20·41	18·00	..	..	4 7 6	4 15 2	,,
916	Superphosphate No. 1, M.L.	Mt. Lyell M. and R. Co. Ltd.	..	..	16·35	17·00	0·88	0·50	1·10	0·50	18·33	18·00	..	..	4 7 6	4 5 2	,,
917	Superphosphate, Wischers	Wischer and Co. Prop. Ltd.	..	..	17·79	17·00	0·29	0·50	1·16	0·50	19·14	18·00	..	..	4 7 6	4 9 8	,,
918	,, ,, ,,	,, ,, ,,	..	..	17·37	17·00	0·27	0·50	1·17	0·50	19·01	18·00	..	..	4 7 6	4 8 4	,,
920	Florida Superphosphate, Sickle	Cuming, Smith, and Co. Prop. Ltd.	..	..	18·08	17·00	1·54	1·00	0·55	2·00	20·17	20·00	..	..	4 7 6	4 15 4	,,
921	,, ,, ,,	,, ,, ,,	..	..	18·20	17·00	1·46	0·50	0·84	0·50	20·50	18·00	..	..	4 7 6	4 16 3	,,
922	,, ,, ,,	,, ,, ,,	..	..	18·12	17·00	0·95	0·50	1·69	0·50	20·76	18·00	..	..	4 7 6	4 15 5	,,
923	Potato Manure (B), Sickle	,, ,, ..	1·20*	1·40	15·88	14·62	1·47	0·76	1·23	1·72	18·38	17·20	4·19	4·16	6 7 6	7 7 1	,,

* Nitrogen present as ammonia.
† 5.44 per cent. nitrogen as ammonia.

List Showing Results of Analysis of Samples of Artificial Fertilizers Collected in Victoria under the Provisions of Sections 16 and 17 of the Fertilizers Act 1915, No. 2652—*continued*.

Label No.	Description of Manure.	Manufacturer or Importer.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Water Soluble. Found.	Water Soluble. Guaranteed.	Citrate Soluble. Found.	Citrate Soluble. Guaranteed.	Citrate Insoluble. Found.	Citrate Insoluble. Guaranteed.	Total. Found.	Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Price asked for the Manure per Ton.	Value of the Manure per ton calculated on Result of Analysis.	District in which Sample was Obtained.
			%	%	%	%	%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	
924	Blood, Bone, and Superphosphate (B), Sickle	Cuming, Smith and Co., Prop. Ltd.	2·55	2·50	7·80	8·50	5·04	2·00	7·33	7·00	20·17	17·50	..	..	6 5 0	5 14 11	Metropolitan
925	Dissolved Bone, and Superphosphate, Sickle	" " "	1·17	1·00	13·05	10·01	3·55	3·88	3·56	5·48	20·16	19·37	..	..	5 10 0	5 3 10	"
926	Florida Superphosphate, Sickle	" " "	..	..	18·11	17·00	1·08	1·00	1·86	2·00	21·05	20·00	..	..	4 7 6	4 16 11	"
927	" " "	" " "	..	..	17·91	17·00	1·03	0·50	1·38	0·50	20·32	18·00	..	..	4 7 6	4 13 11	"
928	" " "	" " "	..	..	17·53	17·00	1·32	0·50	1·86	0·50	20·71	18·00	..	..	4 7 6	4 14 6	"
930	" " "	" " "	..	..	17·17	17·00	1·14	0·50	2·25	0·50	20·56	18·00	..	..	4 7 6	4 12 7	"
931	Superphosphate No. 1, M.L.	Mt. Lyell M. and R. Co. Ltd.	..	..	16·50	17·00	1·53	0·50	0·97	0·50	19·00	18·00	..	..	4 7 6	4 8 9	"
932	Dissolved Bone and Superphosphate, Sickle	Cuming, Smith and Co., Prop. Ltd.	1·41	1·00	12·42	10·01	3·42	3·63	1·97	4·73	17·81	18·36	..	..	5 10 0	5 0 8	"
933	Blood, Bone Fertilizer, and Superphosphate, M.L.	Mt. Lyell M. and R. Co. Ltd.	2·99	2·50	8·50	8·50	5·55	1·75	4·18	6·25	18·23	16·50	..	..	6 5 0	6 5 4	"
934	Bone Fertilizer and Superphosphate (A), Wischer's	Wischer and Co. Prop. Prop. Ltd.	0·80	0·75	13·40	12·75	2·20	1·37	3·44	3·38	19·04	17·50	..	..	5 5 0	4 14 10	"
935	Superphosphate, Wischer's	" " "	..	..	16·18	17·00	1·42	0·50	1·32	0·50	19·08	18·00	..	..	4 7 6	4 7 6	"
936	" "	" " "	..	..	17·93	17·00	1·66	0·50	0·61	0·50	20·20	18·00	..	..	4 7 6	4 15 5	"
937	Florida Superphosphate Sickle	Cuming, Smith, and Co. Prop. Ltd.	..	..	17·55	17·00	1·73	0·50	1·52	0·50	20·80	18·00	..		4 7 6	4 15 9	"
938	Bone Fertilizer, Wischer's	Wischer and Co. Prop Ltd.	2·51	3·00	..	..	9·89	3·00	9·20	13·00	19·09	16·00	..	..	6 2 6	5 10 4	"
939	Barley Manure, M.L.	Mt. Lyell M. and R. Co. Ltd.	1·01*	1·00	16·03	15·00	1·97	0·50	1·60	0·50	19·60	16·00	..	..	5 10 0	5 8 8	"
940	Basic Phosphate, M.L. † ..	" " "	..	..	..	..	13·41	14·00	1·96	3·00	15·37	17·00	..	..	4 5 0	3 5 4	"
941	Bone Fertilizer and Superphosphate No. 1, M.L.	" " "	1·56	1·50	8·89	8·50	3·76	3·25	5·43	5·25	18·10	17·00	..	..	5 12 6	4 19 8	"

* Containing 0.88 per cent. nitrogen as ammonia sulphate.
† This manure is not a basic phosphate, but a mixture of lime and superphosphate.

List Showing Results of Analysis of Samples of Artificial Fertilizers collected in Victoria under the Provisions of Sections 16 and 17 of the Fertilizers Act 1915, No. 2652—*continued.*

Label No.	Description of Manure.	Manufacturer or Importer.	Nitrogen. Found.	Nitrogen. Guaranteed	Phosphoric Acid. Water Soluble. Found	Phosphoric Acid. Water Soluble. Guaranteed.	Phosphoric Acid. Citrate Soluble Found	Phosphoric Acid. Citrate Soluble Guaranteed.	Phosphoric Acid. Citrate Insoluble Found.	Phosphoric Acid. Citrate Insoluble Guaranteed.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed	Potash. Found.	Potash. Guaranteed.	Price asked for the Manure per Ton.	Value of the Manure per ton calculated on Result of Analysis.	District in which Sample was Obtained.
			%	%	%	%	%	%	%	%	%	%	%	%	£ s. d.	£ s. d.	
942	Florida Superphosphate, Sickle	Cuning, Smith, and Co. Prop. Ltd.	..	..	17·73	17·00	1·79	0·50	1·38	0·50	20·90	18·00	..	..	4 7 6	4 16 6	Metropolitan
944	Bone Fertilizer, Ark* ..	A. Murphy ..	3·38	4·06	..	..	6·63	5·69	15·87	11·16	22·50	16·85	..	..	6 0 0	6 8 7	Ararat
945	Bone Fertilizer, Elsworth's	W. R. Elsworth ..	2·90	2·50			4·98	6·00	15·77	11·00	20·75	17·00	..	..	5 15 0	5 12 1	Ballarat
946	Magic No. 1 Fertilizer, Gardiner's	Geo. Gardiner and Co. Prop. Ltd.	1·37	2·00	..		1·50	3·00	13·75	14·00	15·25	17·00	..	..	5 5 0	2 15 8	Geelong
947	Bone Fertilizer, Elsworth's	W. R. Elsworth	1·78	2·50	3·65	†	3·70	6·00	9·74	11·00	17·09	17·00		..	5 15 0	4 10 4	Ballarat

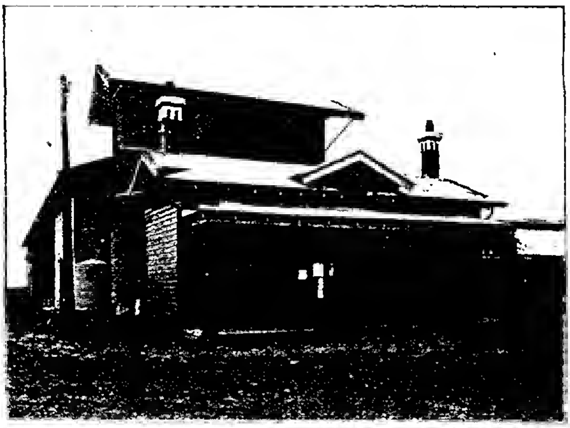
* This sample is really a sample of pure bone dust.
† Water soluble, phosphoric acid not guaranteed.

RED POLL DAIRY CATTLE.

Report on the Departmental Herd for the Season 1915-16.

By R. R. Kerr, Dairy Supervisor.

It has been usual to publish an annual report on the performances of the Red Poll Herd in the September issue, but pressure on the *Journal* space has forced a postponement until now, and will also account for the brevity of the report for the milking year ending 30th June, 1916.

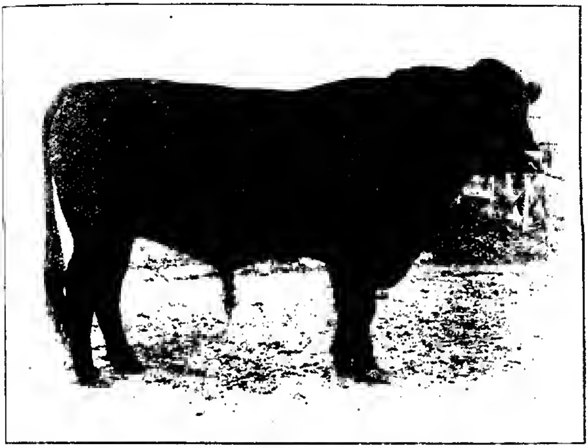


Twin Silos at State Research Farm, Werribee, each 160 tons capacity. Office in foreground.

Reference to the records at the end will show that the average yields are below those of last year to the extent of 56 gallons of milk, and 32 lbs. of butter fat per cow, and that the heifer's yield also averaged 19 lbs. of butter fat less, although their average yield of milk was 40 gallons better.

It is always more difficult to maintain a high average as a herd increases in numbers, and with 46 head recorded this year, as against 31 last year, a reduction in average yield was to be looked for. In point of fact, however, the decreased yield has been due to other circumstances. At Werribee, from a dairying stand-point, the year was a much worse one than the drought year inasmuch as that, with the exception of a few acre-feet in February no water was available for

irrigation from September, 1915, to July, 1916, and the 16 inches of rain which fell during the year was quite inadequate for pasture growth. Consequently, the cattle were deprived throughout the greater portion of the period under review of the ordinary supply of freshly-cut succulent lucerne which, given as a night feed, has been so satisfactory as the bulwark of the daily ration in previous years. Apart from concentrates in strictly limited quantity the herd had to depend mainly on silage and straw chaff. It was indeed fortunate that the



Longford Major (imp. 10445).

By Longford Majiolini (10054) ex Mona (18179).

Mona's (Dam) record—14,713 lbs. milk; 6 years' average, 10,548 lbs. milk.

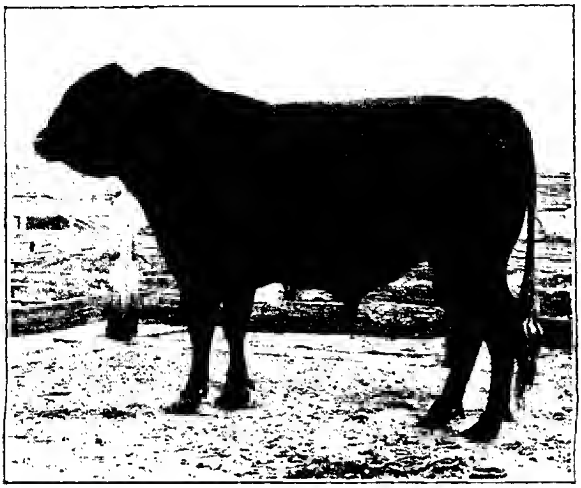
Minnie's (G. Dam) record—10,513 lbs. milk; 4 years' average, 9,155 lbs milk.

Mona's yield, 14,713 lbs. milk, stood as the world's record for Red Polls, until beaten by Muria (14,972 lbs. milk) at the State Research Farm, Werribee, Victoria, in 1915.

farm was able to fill the two silos in the spring with barley and the first cut of lucerne, making in all about 240 tons which, with oaten and pea straw, was made to suffice for the 120 head of cattle on the place. The concentrates fed to the Red Polls is much less than that fed to some of the herds under the Government Herd Test, being only 6 lbs. to freshly-calved cows and to those calved some months 3 lbs. daily. The leading cow, "Birdseye," was receiving 6 lbs. daily for a month, then increased to 8 lbs. until the close of her test period. Had she been pushed her position in the test would have been nearer the top. Under the circumstances 3rd place, amongst the stars of all breeds, is a very creditable achievement. Her full record for 365 days was 9,146 lbs., milk test 6.53, 597 lbs. fat, and 683 lbs. commercial butter.

In the September, 1914, issue of the *Journal* appeared some reference to and the head picture of "Netherlana." She has fully realized expectations and is second top for the herd this year, her record being in 365 days, 11,506 lbs., milk test 4.26, 490 lbs. fat, and 560 commercial butter. On conformation she is the nicest dairy cow in the herd, her special dairy quality always commanding attention.

"Muria," our champion test cow, unfortunately, this year, calved two months prematurely, and as evidence of her exceptional producing powers yielded 54 lbs. daily for some time with nearly 6 per cent. fat; subsequently she did not feed well, consequently did not maintain the



Belligerent (imp.).

By Moor Blush (10460) ex Meadow Rubicon (23118). 3 years. 2nd Prize and Reserve Champion, Melbourne Royal Show, 1916.

Milk Records of Ancestry.

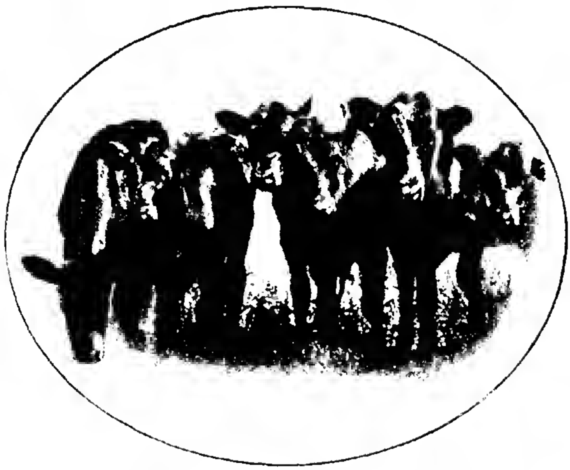
Dam's Record (1st milking) 7,144 lbs. milk.

Dam's Dam's	..	14,533	lbs. milk	..	4	years	average	12,871	lbs. milk.
Sire's Dam's	..	10,376	,,	..	7	,,	..	9,354	,,
Sire's D. Dam's	..	9,510	,,	..	12	,,	..	8,033	,,
G. Sire's D. Dam's	..	10,215	,,	..	7	,,	..	9,386	,,
G.G. Sire's D. Dam's	..	12,565	,,	..	10	,,	,,	8,853	,,
G.G.G. Sire's D. Dam's	..	10,088	,,	..	2	,,	,,	9,754	,,

flow, but even under these adverse circumstances I expect her to be near the top for the herd test report ending June, 1917.

The heifers sired by "Nicotine" are now coming into the herd. "Cutty" x Connecticut," "Mahratta" x "India," Avesia" x "Birdseye," and "Goldlace" x Goldleaf," have nearly completed their term and will give very promising yields, averaging in the vicinity of 300 lbs. fat.

We are now reaching the critical stage as to the value of "Nicotine" as a dairy sire, the period which, in his case brings the sudden realization that there is a lot of truth in that old axiom—"That the bull is half the herd." If one can judge by the many inquiries made for the cattle the breed is increasing in popularity and the opportunity seems to present itself for some enterprising stock breeder to import these



The Rising Generation, showing Quality of Countenance.

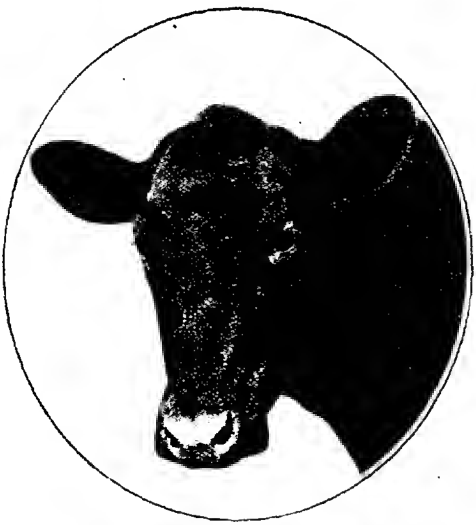
cattle, when circumstances permit. When importing special claims need to be attached to the producing pedigree; there are many of the beef type to be obtained, but special dairy type is rather scarce. The Department has no trouble in disposing of the young bulls; in fact, it cannot cope with the demand, and bull calves from the best cows have been bespoken many times.

"Longford Major" and "Belligerent" (imp.) are leaving nice calves, while the heifer x "Primrose League" (imp.), now eighteen months old, has an udder development not surpassed by the best representatives of the special dairying breeds.

The Red Polls' early maturing qualities give them an advantage of a year over other beef cattle, which is a decided benefit in these times of meat scarcity.

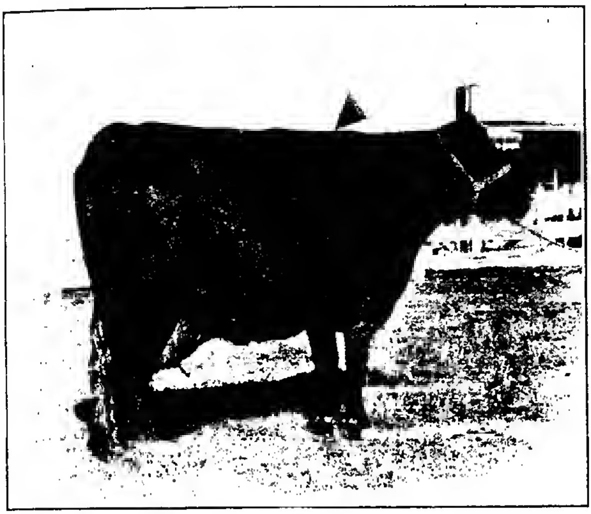
TYPES OF RED POLL HEAD.

" Belligerent " (imp.)



" Netherlana."

Many inquiries have been made by Inter-State beef raisers anxious o secure bulls for mating with shorthorn and common cows, the polled haracter, their blood red colour, early maturity, and extreme docility, re qualities which secure for them many fanciers. Nearly all buyers



"Birdseye."

By Tabacum ex Virginia.

The "Head of the Herd" for Season 1915-16, and third in the Government Herd Test, embracing all breeds.

Record.

1912-13 (first milking) 4,440 lbs. milk, 5.78 test, 256$\frac{3}{4}$ lbs. butter fat, 271$\frac{1}{2}$ lbs. commercial butter.

1913-14 (second milking)—6,543 lbs. milk, 5.48 test, 358$\frac{3}{4}$ lbs. butter fat, 409 lbs. commercial butter.

1914-15 (third milking)—8,522 lbs. milk, 55 test, 469 lbs. butter fat, 535 lbs. commercial butter.

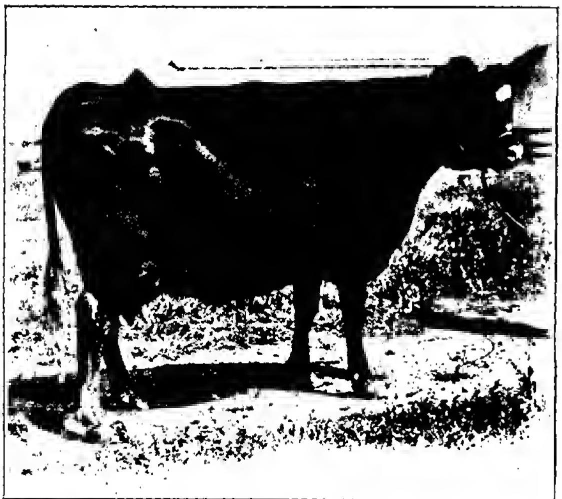
1915-16 (fourth milking)— 9,146 lbs. milk, 6.53 test, 597 lbs. butter fat, 683 lbs. commercial butter.

Show Record.

Second and Reserve Champion, Melbourne Royal, 1914.

First Type and Utility, Melbourne Royal, 1916.

of Red Poll bulls subsequently wish to purchase females, and, of course, want good ones. But the Department could not maintain the high herd standard, and at the same time sell the best of its young females; yielding to the temptation to do that has been the ruination of many herds. The departmental method of selling the young bulls for 1s. for each pound of fat produced during the season by the dam works well. Example: 300-lb. fat cow, calf 300s., equals £15, and so on. This method might be adopted with advantage by many other breeders, both in the interests of the dairying industry, and of their own banking accounts.



"Birdseye."—Dry, and Heavy in Calf.

The University Veterinary School is conducting extensive research work at the farm, and those in authority are hopeful of gaining some valuable information for stock breeders.

The procedure to which the cattle are at times subjected in the carrying out of this work may be somewhat detrimental to the making of milk and butter records, no doubt it is so, but in carrying out experimental work the commercial side must at times be sacrificed to allow the farm to fulfil the object for which it was created.

To the mind of the writer the results achieved by the dairy herd, at the State Research Farm, so far, will be helpful in re-establishing the dairying industry in the Werribee district.

"Netherlana."

By Melton Prince.

Record.

1913-14 (first milking) 4,551 lbs. milk, 4.18 test, 194½ lbs. butter fat. 222 lbs. commercial butter.

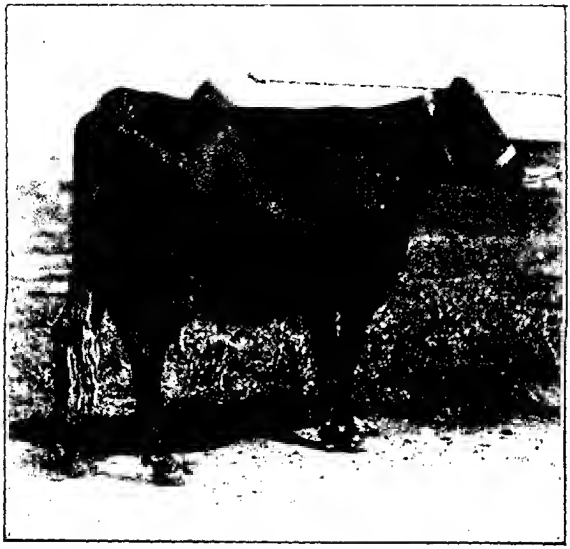
1914-15 (second milking) 6,903 lbs. milk, 4.2 test. 292 lbs. butter fat. 333 lbs. commercial butter.

1915-16 (third milking)—11,506 lbs. milk, 4.26 test. 490 lbs. butter fat. 560 lbs. commercial butter.

Show Record.

Second, 3 year old. Melbourne Royal, 1914.

Second, Type and Utility. Melbourne Royal, 1916.



"Mongolia."

By Acton Dewstone (imp.) ex Asiana by Magician (imp.).

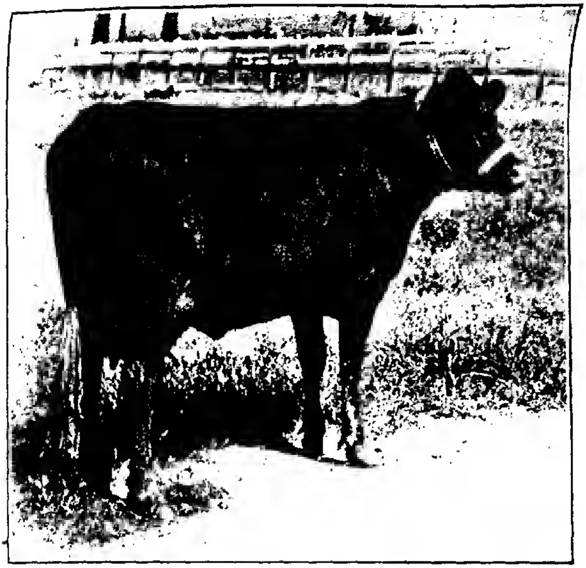
Record.

1914-15 (first milking)—5,799 lbs. milk, 4.2 test, 245 lbs. butter fat, 279 lbs. commercial butter.

1915-16 (second milking)—7,483 lbs. milk, 4.33 test, 323 lbs. butter fat, 369 lbs. commercial butter.

Show Record.

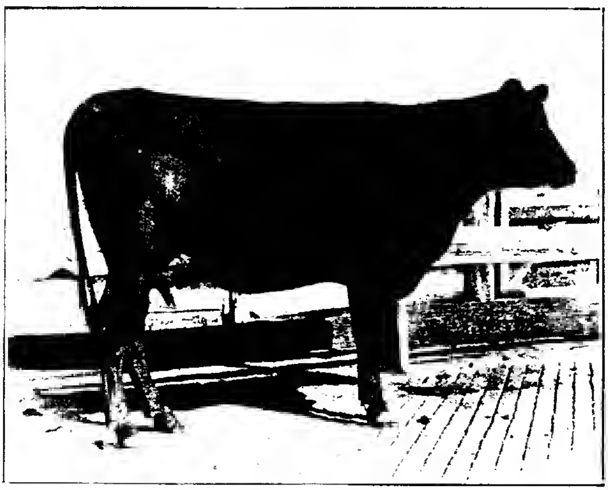
Third, all-age class, Melbourne Royal, 1916.



"Tabelta." By Tabacum ex Vuelta.

"Malaysia." By Acton Dewstone (imp.) ex 4-22 by Magician (imp.).

"Azora," heifer, $2\frac{1}{2}$ years.
By Nicotine ex Atlanta.



"Coinage," heifer, $2\frac{1}{2}$ years.
By Nicotine ex Bullion.

YIELDS AND RETURNS OF THE GOVERNMENT HERD OF RED POLL DAIRY CATTLE.

Season 1910–11.

Cows (2nd Calf).

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Tests.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Value s.
							£ s. d.
Bullion	283	40¼	7,730	4·2–5·0	350·71	406¼	17 16 8
Virginia ..	283	40¼	6,362	3·8–4·6	254·75	290¼	12 14 9
Havana ..	283	40¼	5,750	3·8–4·6	229·97	262¼	11 10 0
Kentucky ..	245	35	5,310	4·0–4·6	225·98	257½	11 6 0
Cigarette ..	238	34	5,040	4·0–4·6	211·61	241½	10 11 7
Beulah	135	19¼	3,970	4·2–4·9	200·44	228½	10 0 5
Average for 6 ..	244¼	30	5,693¾	4·3	246·59	281	12 4 11

Heifers.

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Tests.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values.
							£ s. d.
Vuelta	270	38½	5,560	7·0–7·8	405·14	461¾	20 5 1
Connecticut ..	283	40½	6,182	4·2–4·6	269·06	306¾	13 0 0
Carolina ..	283	40½	5,700	4·2–4·8	253·14	288¼	12 13 1
Murla	283	40½	5,480	4·2–6·2	240·70	274¼	12 0 8
Cuba	283	40½	5,260	4·2–4·8	231·89	264¼	11 11 11
Pennsylvania ..	270	38½	4,610	4·0–4·4	189·75	216¼	9 9 9
Average for 6 ..	278¾	34	5,465	4·7	269·94	300·12	13 4 11

Season 1911–12.

Cows.

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Average Test.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values
							£ s. d.
Vuelta	289	41¼	7,750	5·2–8·2	485·1	553	24 5 1
Connecticut ..	283	40½	6,780	4·6–6·4	364·0	415	18 4 0
Bullion	305	43½	6,940	4·8–6·2	344·0	392¼	17 4 0
Beulah	278	39¾	6,460	4·9–6·4	342·0	390¼	17 2 7
Cuba	304	43½	7,015	4·4–8·4	337·8	385	16 17 9
Cigarette ..	291	41½	6,480	4·0–5·6	285·9	326	14 6 0
Sumatra ..	293	42	6,660	4·0–5·0	284·2	324	14 4 1
Kentucky ..	277	39½	6,690	4·0–4·8	277·7	316¼	13 17 8
Muria	286	41	5,800	4·5–7·0	275·7	314¼	13 15 8
Pennsylvania ..	318	45½	6,340	4·0–5·2	271·9	310	13 12 0
Carolina ..	226	32¼	5,800	4·0–5·0	254·3	280	12 14 4
Virginia	277	39½	5,510	3·9–4·6	221·7	252¾	11 1 9
Havana ..	262	37¼	5,350	3·8–4·5	215·3	245¼	10 15 4
Average for 13	283	40½	6,355	4·7	304·6	346¾	15 4 7

Season 1912–13.

Cows.

Name	Days in Milk.	Weeks in Milk.	Milk in lbs.	Tests.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values. £	s.	d.
Muria	256	36½	5,780	4·5–7·3	314·96	359	15	15	0
Bullion	239	34	6,490	3·8–6·8	296·90	338½	14	16	10
Egypta	295	42	6,581	3·7–5·2	283·5	323	14	3	6
Virginia	259	37	6,500	3·6–5·7	282·56	322	14	2	6
Cigarette ..	273	39	6,810	3·9–4·8	278·56	317½	13	18	6
Connecticut ..	320	45¾	6,100	4·0–7·6	277·85	316¾	13	17	10
*Vuelta ..	263	37½	6,650	3·5–5·3	273·81	312	13	13	9
Cuba	251	36	6,280	3·9–5·4	269·11	306¾	13	9	1
Kentucky ..	267	38	6,249	3·4–4·4	256·00	291¾	12	16	0
Havana ..	258	37	6,060	3·5–5·5	252·05	288¼	12	12	11
Sumatra ..	230	33	5,670	3·7–5·5	238·37	171¾	11	18	4
Pennsylvania ..	230	34½	4,910	3·8–5·9	215·09	245¼	10	15	0
Europa	324	46¼	4,590	3·6–7·1	201·13	229¼	10	1	1
Carolina ..	274	39	4,450	3·6–6·5	198·30	226	9	18	3
Average for 14 Cows ..	267	38	5,912	4·85	259·94	295	12	19	10

* Suffered from eye accident for a considerable period.

Heifers.

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Average Test.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values. £	s.	d.
Goldleaf	287	41	6,590	4·1–5·3	316·50	360	15	16	6
Birdseye ..	285	41	4,440	3·9–8·0	256·75	292¾	12	16	9
India	267	38	5,231	4·1–6·2	238·27	271¼	11	18	1
Persica	252	36¼	4,100	4·6–7·7	218·69	249¼	10	18	8
Turka	191	27¼	3,590	4·6–5·9	178·27	203¼	8	18	3
Mexicana ..	210	30	3,830	4·0–5·1	171·55	195½	8	11	6
Regalia ..	338	48¼	3,380	4·4–6·0	161·58	184¼	8	1	0
Cabana	273	39	3,370	4·0–5·4	153·23	174¼	7	13	3
La Suelta ..	241	34¼	2,660	4·3–8·2	134·23	153	6	14	3
Average for 9 Heifers ..	260	37	4,132	5·3	203·24	232	10	3	3

Season 1913–14.

Cows.

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Average Test.	Butter Fat (lbs.)	Estimated Butter (lbs.)	Values. £	s.	d.
Cigarette ..	328	46¾	9,414¼	4·12	388·25	442½	19	8	3
Muria	298	42½	7,487½	5·08	380·25	433½	19	9	3
Birdseye ..	297	42¼	6,542¾	5·48	358·75	409	17	18	9
Virginia ..	304	43½	8,229	4·33	356·75	396¾	17	16	3
Bullion	297	42½	8,177¾	4·29	350·75	400	17	10	9
Sumatra ..	330	47¼	7,605	4·26	323·75	368¼	16	3	0
Vuelta	286	43¾	7,723½	4·14	320	364¾	16	0	0
Connecticut ..	273	39¾	7,166	4·47	318·25	362¾	15	18	3
Persica	298	42½	6,954¼	4·57	318	362½	15	18	0
Kentucky ..	238	39¾	7,904½	3·96	313·25	357	15	13	3
Goldleaf ..	277	41	6,908	4·49	310·25	353½	15	10	3
Mexicana ..	293	41	6,773¾	4·56	309·25	352½	15	9	3
Cuba	287	41¾	6,624¼	4·47	296·25	337¾	14	16	3
Europa	302	43	6,273	4·60	289·25	329¾	14	9	3
Egypta	288	41	6,724	4·13	277·75	316¾	13	17	9
India	245	35	6,150	4·36	268·5	306	13	8	6
Havana ..	240	34¼	6,364½	4·15	264·25	301¼	13	4	3
Turka	289	41¼	5,534¼	4·69	259·75	296	12	19	9
Asiana	260	37	4,249¾	5·30	225·5	257	11	5	6
Pennsylvania .	249	35½	5,160	4·4	212·25	242	10	12	3
Regalia .. .	297	42½	4,444	4·50	200·25	228¼	10	0	3
Carolina .	231	33	4,322¼	4·62	200·25	228¼	10	0	3
Averages of herd of 22 cows	284¼	40¾	6,669¾	4·49	297·25	338½	14	17	3

Season 1913–14—*continued.*

Heifers.

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Average Test.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values. £ s. d.
Atlanta ..	300	42¾	5,505¼	4·90	277	315¾	13 17 0
Germania ..	359	51½	4,218¼	4·74	199·75	227¾	9 19 9
Arctica ..	294	42	3,768¼	5·16	194·5	221¾	9 14 6
Netherlana ..	293	41¾	4,551¼	4·18	190·5	217¼	9 10 6
Hispana ..	290	41½	3,944¾	3·95	155·75	177½	7 15 9
Melanesia ..	276	39½	3,690¼	3·97	146·5	167	7 6 6
Averages for 6 heifers ..	302	43¼	4,279¾	4·48	194	221	9 14 0

Season 1914–15.

Cows.

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Average Test.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values. £ s. d.
Muria ..	365	52	14,972	5·9	884·6	1,007·94	44 4 7
Persica ..	351	50	9,607	4·9	479·94	547·13	23 19 11
Cuba ..	337	48	10,464	4·5	478·14	545·07	23 18 1
Birdseye ..	321	45¾	8,522	5·5	473·79	540·12	23 13 9*
Bullion ..	321	45¾	10,928	4·3	468·09	534·64	23 8 11
Virginia ..	344	49	10,252	4·4	456·76	520·13	22 16 9†
Pennsylvania ..	348	49¾	10,607	4·1	437·42	498·65	21 17 5
Sumatra ..	290	41½	9,232	4·6	431·49	491·89	21 11 6
Egypta ..	327	46¾	10,646	3·9	418·55	477·11	20 18 6
Mexicana ..	282	40¼	8,641	4·6	399·75	455·71	19 19 9
Europa ..	347	49½	8,765	4·4	387·11	441·30	19 7 1
Goldleaf ..	362	51½	8,415	4·4	377·67	430·54	18 17 8
Phillipina ..	281	40½	6,829	5·0	343·33	391·39	17 3 4
Vuelta ..	239	34	7,560	4·4	338·28	385·64	16 18 3
Connecticut ..	259	36¾	6,878	4·7	325·48	371·04	16 5 6
Turka ..	279	39¾	6,395	4·9	316·07	360·31	15 16 0*
Ardath ..	332	47½	6,261	4·8	302·91	345·31	15 2 10
Asiana ..	279	39¾	5,938	4·9	292·61	332·62	14 12 0
Netherlanas ..	292	41½	6,903	4·2	291·78	332·62	14 11 9
Havana ..	325	46½	7,001	4·0	285·86	325·88	14 5 10†
Cameo ..	303	43¼	5,536	5·1	285·60	325·58	14 5 7
Albina ..	286	40¾	6,995	3·9	276·86	315·62	13 16 10
Atlanta ..	252	36	5,635	4·7	266·90	304·26	13 6 10
Hispana ..	365	52	6,574	3·6	241·69	275·52	12 1 8
Kentucky ..	281	40	6,068	3·9	239·51	273·04	11 19 6†
India ..	241	34¼	4,578	4·9	225·30	252·75	11 5 3
Averages of herd of 26 cows ..	308	43¾	8,084½	4·6	374·03	420·39	18 14 0

* Was sick a few days. † Suffered from lameness.

Heifers.

Name.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Tests.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values. £ s. d.
Pipio ..	334	47¼	6,802	4·8	326·37	372·06	16 6 4
Contessina ..	311	44¼	6,706	4·2	282·88	322·48	14 2 10
Samorna ..	365	52	5,490	4·9	271·76	309·80	13 11 9
La Reina ..	342	48¾	5,070	5·1	261·96	298·63	13 1 11*
Mongolia ..	301	43	5,799	4·2	244·95	279·24	12 4 11
Sylvia ..	301	43	4,897	4·7	235·79	268·80	11 15 9
Tuckahoe ..	322	46	4,374	4·7	206·38	235·27	10 6 4
Averages of herd of 7 heifers ..	325	46¼	5,591	4·6	261·44	298·04	13 7 1

* Calved two months prematurely.

Season 1915–16.

Cows.

Name of Cow.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Average Test	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values, 1s. lb. Fat. £ s. d.
Birdseye ..	365	52	9,146	6·53	597	683	29 17 0
Netherlana ..	365	52	11,506	4·26	490	560	24 10 0
Violet III. ..	365	52	9,172	4·66	427	488	21 7 0
Phillipina ..	365	52	8,213	4·87	400	457	20 0 0
Connecticut ..	357	51	8,313	4·80	390	456	19 10 0
Persica	346	49	7,800	5·00	394	451	19 14 0
Lily	365	52	8,525	4·59	392	448	19 12 0
India	365	52	8,556	4·56	390	445	19 10 0
Cuba	324	46	8,400	4·55	382	437	19 2 0
Kentucky ..	338	48	9,893	3·86	382	437	19 2 0
Mexicana ..	310	44	8,421	4·44	374	427	18 14 0
Picotee	365	52	8,490	4·36	371	424	18 11 0
Vuelta	328	47	9,130	4·00	368	420	18 8 0
Sumatra ..	322	46	8,135	* 4·45	362	414	18 2 0
Ardath	365	52	7,339	* 4·84	355	406	17 15 0
Primrose League (Imp.) ..	365	52	8,060	4·39	353	403	17 13 0
La Reina ..	329	47	6,712	5·13	344	394	17 4 0
Bullion	317	45	7,504	4·10	330	377	16 10 0
Pennsylvania ..	278	40	8,256	4·00	330	376	16 9 0
Mongolia ..	283	40	7,483	4·33	323	369	16 3 0
Pipio	317	45	6,274	5·09	319	365	15 19 0
Britannia ..	320	47	7,637	3·94	301	343	15 1 0
Goldleaf ..	248	35	6,665	4·43	295	337	14 15 0
Samorna ..	365	52	6,198	4·75	294	336	14 14 0
Asiana	279	40	5,933	4·90	292	332	14 12 0
Egypta	303	43	7,136	4·02	287	328	14 7 0
Cameo	285	41	6,036	4·72	285	325	14 5 0
Alpina	344	49	7,094	3·99	283	323	14 3 0
Sylvia	303	41	5,286	4·84	256	292	12 16 0
Tennessee ..	347	50	5,914	4·17	246	281	12 6 0
Africana ..	303	43	5,082	4·72	240	274	12 0 0
Tasmania ..	325	46	5,112	4·52	231	264	11 11 0
Canada	275	39	4,918	4·07	200	228	10 0 0
Average for 33 cows ..	330	47	7,525	4·54	342	391	17 2 0

Butter fat at 1s. per lb., £17 2s.; milk at 8d. per gallon, £25 14s. 10d.

Heifers.

Name of Heifer.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Average Test.	Butter Fat (lbs.)	Commercial Butter (lbs.)	Values, 1s. lb. Fat. £ s. d.
Carribea ..	365	52	7,142	4·35	310	354	15 10 0
Japana ..	357	51	7,788	3·63	283	322	14 3 0
Seriea	365	52	6,092	4·45	271	309	13 11 0
Itala	365	52	6,346	4·10	261	297	13 1 0
Oceana ..	365	52	6,247	4·11	256	292	12 16 0
Russia	365	52	6,413	3·96	254	290	12 14 0
Panama ..	288	41	5,997	4·24	254	290	12 14 0
Ontario ..	365	52	6,059	4·15	251	286	12 11 0
Soudana ..	346	49	5,486	4·54	249	284	12 9 0
Pacifica ..	365	52	4,979	4·88	243	278	12 3 0
Laurel	325	46	4,654	4·86	226	257	11 6 0
Barbery ..	359	51	5,387	3·72	200	228	10 0 0
Congo	296	42	4,449	4·21	187	213	9 7 0
Average for 13 heifers ..	348	50	5,995	4·06	242	277	12 2 0

Butter fat at 1s. per lb., £12 2s.; milk 8d. per gallon, £19 19s. 8d.

FARM NOTES.

The parsnip is one of the most nutritious of all root vegetables, containing more solids, and, therefore, more actual nourishment, than either the potato, turnip, or carrot. It may be employed to a certain extent as a substitute for meat.

Comparing England and Wales at the time of the war against France in 1801, "the population was then 8,892,536, so there were 35½ acres under wheat for every hundred inhabitants. In 1914 the population was 37,302,983, and for every hundred inhabitants there were five acres under wheat."

A Closed pail will exclude three-quarters of the dirt that would otherwise be found in the milk. Clean hands and clean overalls contribute toward a clean product. The milking-room should be kept free from dust and strong odours; manure, bedding, hay, or silage should be handled only after the milk has been removed from the barn.

To have the products as large and even at the bottom of the bag or box as they are on top is honest packing. But somehow the large specimens frequently find their way to the top of the receptacle. Proper precautions as to grading always lead to honest packing. Buyers soon learn which producers pack straight and use no deception in packing their products. One can pack dishonestly.

Germs are organized ferments, and are the most minute forms of life. They are of inestimable value to the dairyman where butter and cheese are made. It is due to the action of these small organisms that the desirable flavours in dairy products are present. Many kinds of germs produce taints, &c., in milk, but this class of bacteria may be kept in check by producing and treating the milk under proper conditions.

A Wellington paper states that the New Zealand "flax" industry is booming, owing to enhanced prices. One large mill would be clearing £2,000 per week. There are hundreds of small mills in New Zealand. This fibre plant (*Phormium tenax*) thrives well in Victoria in suitable damp localities, and, in view of the demand ruling, attention may be directed to an article in this Journal of June, 1906, when instructions for the establishment of plantations were given. Since that date prospects have further improved by better methods of handling the leaf.

Chlorophyll or leaf-green is a compound of nitrogen. When a crop does not get enough nitrogen from the soil, its colour is bad, and nitrogenous manures on worn-out or poor soils improve the yield. But the lack of colour may also be due to water troubles—either too much water or too little.

THE SUMMER BUD OR YEMA GRAFT OF THE VINE.

By F. de Castella, Government Viticulturist.

(Continued from page 52, Vol. XV., 10th Jan., 1917.)

The Budding Knife.

Almost any knife is suitable for the purpose, provided it has a narrow blade and is capable of being sharpened to a razor edge. The usual forms of knife used for budding citrus, roses, &c., may be used, though the handle is not a very convenient one, in view of the rather heavy cutting required, nor is the spatula-like end of the ivory handle necessary for the Yema graft. A very suitable knife is made by Messrs.

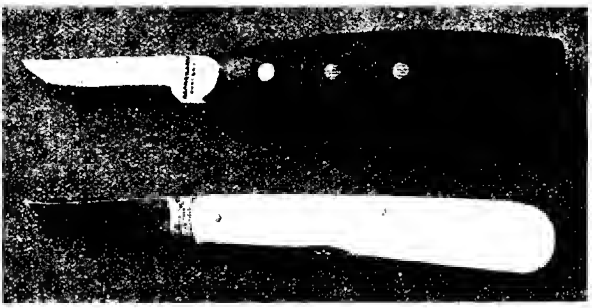


Fig. 8.—Budding Knives.

The lower knife, with thin ivory handle, is one of the standard brands of English knives used for budding citrus, roses, &c. The upper knife, specially designed for the "yema" graft, is made in Victoria. The blade does not fold, but is provided with a stout leather sheath.

Barker Brothers, of 262 Victoria-street, Richmond, Victoria, with stout, wooden handle, such as can be firmly gripped by a man's hand. This knife is illustrated in Fig. 8.

A guard made of fairly stout leather, and roughly shaped like the thumb of a glove, will be found a useful precaution; it will enable the knife to be used in trimming the scion against the right thumb without danger of cutting oneself.

Subsequent Care of the Grafts.

The grafts, after having been duly executed, tied, if necessary, and mounded up as described in last issue, require, as a rule, no further attention until the early spring following. It is well, however, to examine one or two of them occasionally, in order to watch the progress of the union, and to see whether or not the string with which they have been bound wants cutting. Sometimes the formation of callus

is so rapid and abundant as to necessitate the removal of the tie a few weeks after grafting. As a rule, the string rots and disappears without any interference being necessary, but it may happen that the soil of the mound remains so dry that the string does not rot; this dryness of the mound need not cause alarm; though a mellow and slightly moist state of the mound provides the best possible conditions, it is far better for it to be too dry than too wet. The scion obtains its supply of moisture from the stock and not from the soil, the function of which is merely to prevent it from drying up, and for this purpose dry, loose soil is very effectual. Should the string appear to be causing undesirable constriction to the new tissues which are forming, it will be well to remove it, the mound being carefully made up again as soon as this has been done.

A mistake which might easily be made in irrigated vineyards, and against which it is here well to give an emphatic warning, is the watering of the vines shortly after they are grafted; the results of such a course would in most cases prove disastrous. A watering a fortnight or so *before* grafting is always beneficial, as it insures the vines being well "in sap," but any water applied afterwards tends to hinder, rather than to promote success, and may cause most serious damage. With the exception of attention to the tie, the grafted vines can be left to themselves until early spring, when they will require staking, and the upper portion of the stock will need cutting back. In order to facilitate winter cultivation it will usually be found convenient to roughly cut the canes of the stock, after the fall of the leaves, as at *c, c, c, c*, Fig. 9.

Cutting back the Stock.

In early spring when vine buds commence to sprout the grafts must be inspected; it is then easy to distinguish between those which have succeeded and those which have failed. The latter will be spring grafted (ordinary cleft graft) in the usual way during September October, or November, as may be thought most suitable according to the nature of the season. In the case of successful grafts the removal of the upper portion of the stock must now receive attention. The vine will now have the appearance of Fig. 9. Each graft which has taken will now also be staked, as shown in Figs. 9 and 10, for reasons which will be explained presently.

The manner in which the stock is cut back is a matter of considerable importance, though opinions differ somewhat as to which is the best method. On no account should the whole of the upper portion be removed by cutting close to the recently inserted bud (at *y*, Fig. 10): to do so would probably result in the stock dying back for the length of a couple of inches on the side opposite to the bud in such a way as to inevitably produce a faulty stem. If, however, the stock is cut off at *x*, Fig. 10, this danger will be avoided: the stub of stock wood thus left dies back gradually to the neighborhood of the bud graft, and it can be removed a year later when completely dead. An even better way is to cut the stock back, as shown in Fig. 9, or in other words, only partially, a small spur being left with a couple of eyes: these will send out two small canes, which will be stopped back severely, as shown in Fig. 10, but which will allow enough sap to circulate in the stem of the stock to insure its remaining alive until the union between the

scion and the stock has become very complete and perfect. The only drawback to this last method is that rather more care and attention are necessary; if too much get away for the sap of the stock is allowed, by omission to stop back and severely limit the stock shoots, the scion bud may fail to shoot, and remain dormant, even though completely knitted to the stock.† A course recommended by a vinegrower of wide experience consists in pruning as shown in Fig. 9 (*a*, *a*, *a*), in August, and stopping the stock shoots (*t*, *t*, Fig. 10) in September or October, finally beheading the stock (*x*, Fig. 10) at harvest time (November, December). This will probably be found generally the most satisfactory methods.

Staking.

When suppressing the top of the stock the young vine should also be staked; if intended to be so trained the permanent stakes can now be placed in position. If the vineyard is to be trellised, the insertion of a temporary stake will be necessary. On no account must staking be omitted; the bud grafted the previous February or March sends out, in September, a strong shoot (see Fig. 10) which may almost be compared to an asparagus sprout; this grows with extreme rapidity and, together with its foliage, presents a large surface to the wind. The bud is only held in position by the recently formed callus tissues, which are still soft and rather spongy, and not yet consolidated by the woody fibres which will shortly make their appearance. If not carefully tied to a stake, there is great danger of breakage by wind, in which case it is not alone the young shoot which is broken off, but the whole scion bud is often lifted right out, callus and all; the graft, of course, being irreparably destroyed.

This same rapid growth, which constitutes a danger, if not guarded against by staking and tying, is largely responsible for the great perfection of the unions resulting from the Yema graft. In the case of ordinary spring grafting, it is usually necessary to wait until the vines have sprouted and bear shoots several inches long before they can be grafted; the stock is then cut right back. The vine is thus compelled to make a second start. With the Yema, however, from the very commencement of the season, practically the whole of the sap sent up from the stock goes into the scion bud, the growth of which is extraordinarily vigorous. New tissues form around its base in great abundance, thus resulting in a very perfect union: the rapidly developed vessels are large and direct, so that a Yema graft, if properly executed, will present less obstruction to the free flow of sap than most other forms of graft.

The temporary stakes need not be very long; two feet out of the ground will suffice to insure protection against breakage and a straight stem to the young vine. It is well to dip the lower ends of the stakes in kerosene, before driving them into the ground, as a precaution against white ants.

† An interesting case came under the writer's notice recently near Rutherglen. Some resistant stocks, planted in August, 1914, were "Yema" grafted in February, 1915. Owing to insufficient cutting back of the stock in September, 1915, numerous buds failed to sprout. It was assumed that they were dead, and the stocks were again grafted by the same method in February, 1916. On the stock being cut back severely in September, 1916, both grafts grew, thus proving that the 1915 ones were not dead, but dormant.

OTHER PRECAUTIONS.

In other respects the young vines require the same care as is necessary in the case of nursery raised bench grafts, or young field grafts.

Cutworms (*Agrotis* Caterpillars) constitute one of the greatest dangers; there being only one bud, yema grafts are even more sus-

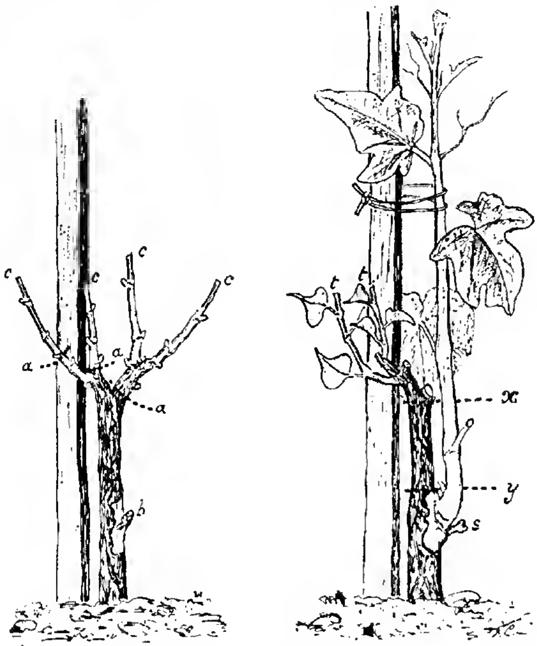


Fig. 9.—Young resistant vine in August, 12 months after plantation. The stock was bud-grafted at b the previous February. The canes were roughly shortened during winter at c, c. c, c, to facilitate cultivation; they are further pruned in August at a, a, a.

Fig. 10.—Same Vine as in Fig. 9, seen in October, or early November. The stock shoots have been severely stopped at t, t, and the shoot from the bud graft has been tied to the stake. The stock may be cut back at x. either in August-September, or as late as December. On no account should it be now finally cut back at y; this must not be done until the following winter, which will be the second one after the vine was grafted.

ceptible to damage than ordinary cleft grafts. If large cutworms are about, they may eat the young shoots out so completely as to destroy the latent buds at its base, in which case the graft must necessarily fail. The usual precautions—arsenate of lead spray, or arsenical baits if

the cutworms have reached a large size*—will afford complete protection, but neglect in this direction may easily prove disastrous.

Care must also be taken to guard against the emission of suckers by the stock and roots by the scion, in the same way as is necessary with grafted vines in general. It may be well to remind those unfamiliar with reconstitution methods that these are two of the greatest dangers to be combated in establishing a vineyard on resistant stocks. Of the two, scion roots merit a special warning; suckers are above ground, and an eyesore which a careful vinegrower removes as soon as he notices them, but scion roots being underground may escape detection unless the young vines are carefully inspected. It is true that there is rather less trouble in both these directions with the Yema graft than with the ordinary spring graft; owing to the perfection of the union, the sap flows more freely into the scion bud, and there is not that back pressure of sap resulting from the obstruction presented by the incomplete union of the recently executed graft, which so frequently brings about the growth of suckers.

Variation in Time of Grafting.

As has been previously pointed out, February is the most suitable month for this graft. In this case the bud remains dormant until the following spring. This may be termed the normal Yema graft; many variations are, however, possible. It may be executed, for example, in spring, as recommended by Mr. Maïs (see *Journal* for January, page 45). In this case, scions from the previous year, prevented from sprouting by storage in cool, almost dry, sand must be used. The scion bud grows almost immediately after its insertion and the method becomes more similar to ordinary spring grafting, over which it does not seem to present much advantage; some practical growers, in fact, hold it to be distinctly inferior.

Another variation consists in Yema grafting a good deal earlier than according to the normal method; if the operation be performed about Christmas time, or early January, the upper part of the stock being suppressed a fortnight after grafting, the bud will no longer remain dormant, but will start to sprout immediately. The advantages of such a course are safety from cutworms and frost, but it is only in certain seasons that this variation is really satisfactory.

A vineyard was grafted in this way near Rutherglen in early January, 1915, with highly satisfactory results. The summer of 1914-15 was, however, quite an unusual one, and probably more suitable for this departure from the normal graft than an ordinary one would be. The extreme dryness of the spring of 1914 (the close of the disastrous drought) resulted in thoroughly ripened canes being available for scions, much earlier than usual, whilst the heavy December rains insured vigorous sprouting of the buds shortly after they were grafted. This case is mentioned as showing the great elasticity of the Yema graft, and the way in which a skilful grower can take advantage of abnormal conditions. If the buds sprout immediately, and the season is such that good growth results, and the canes ripen satisfactorily, a season will no doubt be saved, but such a result cannot be relied upon every year,

* See article on Cutworm Destruction in *Journal* for July, 1911, a reprint of which is available on application.

and in a general way it will be safer to rely on the normal Yema graft with dormant bud, which will give entire satisfaction in every case, provided it is properly executed, and that there is sufficient "life" in the stock. Even though the latter condition be not realized, no harm will result to the young resistant vine, which will not be prejudiced in any way so far as subsequent spring grafting is concerned.

The Cadillac Graft.

Reference must now be made to this well known French graft which, although practised in much the same way as ordinary cleft grafting, has much more in common with the Yema graft, as regards the season of the year most suitable for its execution. This graft takes its name from the district around the small town of Cadillac, about 20 miles up the river Garonne from Bordeaux. It was invented by M. Constant Ballan, a vine grower of Omet, a village near Cadillac; and has since become extremely popular in many parts of southern France. The following description of the graft is abridged from a report by Professor Capus‡:—

"In the second fortnight of August (February in Australia) a basin is opened around each young resistant vine. About 4½ inches above the ground level a section is made on the main stem of the stock in an oblique direction, and towards the pith. It is into this cleft, which is 1½ inches deep, that the scion is introduced, prepared as though for the ordinary cleft graft, and with two eyes.

Each graft is bound by means of a narrow lead band, the ends of which are twisted together. A tie of raffia is also made around it, the strands of which are kept apart. The raffia also serves the purpose of holding the upper part of the scion against the stock, thus keeping it firmly in position. The scions are cut from French vines and from canes of the year, the wood of which is sufficiently ripened. The grafts are mounded up to the second or top eye of the scion.

The buds of the scion generally remain dormant and only sprout the following spring. The stock continues its growth during the whole of the autumn. In winter it is pruned as though it had not been grafted, only one spur being left on the highest canes.

In April (October in Australia) when the buds are about to break, the grafts are inspected; non-sprouting of the scion bud is an indication that the graft has failed. These are then re-grafted, below the cleft previously made, and at the same time of year as ordinary spring grafting.

Progressively, and as they sprout, the shoots of the stock are stopped back, so as to direct the flow of sap towards the graft and the scion.

In spring, after breaking down the mounds, the grafts are again inspected, and the binding is replaced; a little later scion roots and binding are removed. As soon as the shoots of the scion are 15 inches long and the union secure, the stocks are beheaded.

Strikes of up to 80 and 90 per cent. are thus obtained. What has been termed the Cadillac graft is not as will be seen, a special method of grafting. This expression designates a system of reconstitution, the originality of which lies in the grafting being executed in August (February in Australia) on a stock in full sap, the upper part of which is not cut off, with scions cut from the current year's canes; thus rendering it possible to field graft the following spring any vines which may have failed."

This graft is illustrated in Fig. 11, which needs little further explanation. According to M. Vermorel (*Le Greffage pratique de la Vigne*):—

"The knife used to make the cleft should have a very thin blade, and the section must be absolutely straight, otherwise there would be difficulty in getting the stock and scion to fit. In order to avoid making a hollow (curved) cleft,

‡ The reconstitution of the vineyards in the Canton of Cadillac. Report submitted to the Jury of Classes 36, 38, and 60, at the Paris Universal Exposition of 1900.

the knife must be very sharp, and used with a saw-like action, care being taken to always keep the blade in the same plane. A guide and a special knife have been devised, which permit of the graft being executed without cutting too deeply into the stock."

This graft, which is very popular in France, has also been tried with successful results, though on a rather limited scale by several Victorian growers. It is convenient to execute when the stocks are rather too large for the Yema graft, in which case the cleft should not penetrate as far as the pith of the stock, as would be the case when stock and scion are of the same diameter. With rather large stocks, it is as well to commence cutting the scion at a different level on the two sides; the one against the stock being the higher. In other respects, and as regards subsequent treatment, what has been written above concerning the Yema graft applies also to the Cadiallac graft.

Fig. 11.—The "Cadillac," or Side-cleft Summer Graft.

Theoretical Considerations.

Without going fully into the details of the rather complicated mechanism by which stock and scion become united in the graft, one or two points in connexion therewith may be briefly outlined, the proper understanding of which should prove of use to the practical grafter.

It must be remembered that in any form of graft the woody tissues of stock and scion never unite—what was already wood prior to grafting cannot do so—the new layers of wood, however, both of stock and scion, which have formed subsequently to the operation of grafting.

are absolutely united if the union is satisfactory. Now, all new tissues of the vine, whether of wood or bark, have one common origin, and this is the thin layer of cells known as cambium, the importance of which is altogether out of proportion to its size or, to be more exact, to its thickness. It is well to thoroughly understand where this cambium layer is situated; this is shown in Fig. 12, which illustrates diagrammatically a section through a yearling cane of vine. The central pith, perhaps rather more plentiful than is usual, is surrounded by a ring of wood, the fibro-vascular bundles of which are separated by medullary rays which extend from the pith to the bark. The cambium layer is shown at *c*, Fig. 12, where it is represented by a line separating the wood from the inner bark or phloem (also called bast tissue).

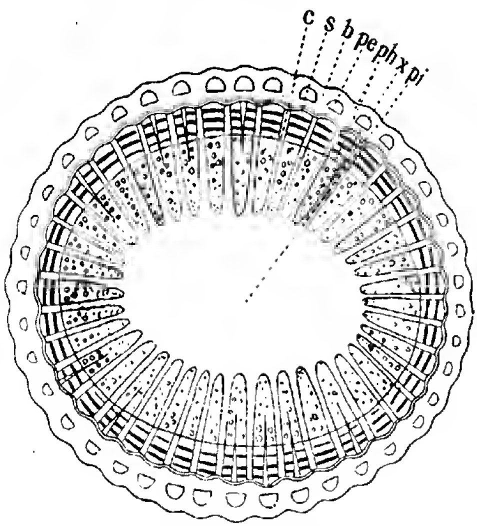


Fig. 12.—Diagrammatic Section of a Yearling Vine Cane (after Guillon).

c. cambium layer; *x*, wood (fibro-vascular bundles separated by medullary rays); *ph*. phlœm or inner bark, also termed bast layer; *s*. cork layer of bark; *b*. outer bark; *pe*, pericycle (fibres of outer bark); *pi*. central pith.

The cambium layer consists of very active cells which, when the vine is in full sap, are so soft and tender as to allow the bark to be readily lifted from the wood. The almost gelatinous condition of this layer at such a time explains the old, though erroneous, term of cambium fluid. This layer is nevertheless composed of true tissue, the cells of which multiply rapidly, producing, on the inner side new wood, and on the outer side new bark. It will suffice for the practical grafter to realize that it is only at the cambium layer that new tissues are formed: this layer therefore plays a preponderant part in the formation of the union between stock and scion.

Unless the sections of this layer are sufficiently close to one another the new tissues will not unite, and the graft must fail. When a vine cane is severed, and the cut ends are placed under suitable conditions of temperature and moisture, nature heals the wound by causing the cambium layer to throw out a cushion of healing tissue, or callus. In the case of a graft, the cambium sections are so close to one another that the masses of callus produced by stock and scion soon meet and press strongly against one another. Exchange of cell contents takes place between them by osmosis and shortly vessels and woody fibres make their appearance; the cambiums of stock and scion each produce wood internally and bark externally, with all the anatomical details peculiar to each, and these new layers are continuous and intimately united; in

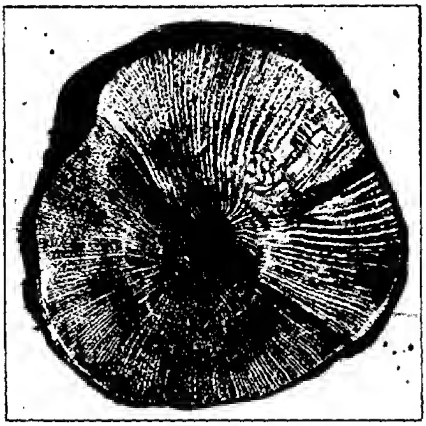


Fig. 13.—Photograph of a Section through a successful "Yema" Graft, a Year after Grafting.

The soft wood of the European (*vinifera*) scion is shown on the upper right-hand half, whilst the denser wood of the resistant stock occupies the lower left-hand half. The radial split, to the right of the photograph, occurred during the drying of the specimen.

other words, the graft has taken. As M. Vermorel concisely puts it§ "a graft is a common cicatrization, or healing of two wounds placed in contact."

Fig. 13 shows the very thorough manner in which the new tissues of stock and scion unite in a successful Yema graft; this is an actual photograph of a section made through a Yema graft, at about the middle of the scion bud, rather more than a year after the execution of the graft. The woody part of the original bud (now dead) is the black portion near the centre; around this is the new ring of woody tissue, formed since the knitting of stock and scion. A marked difference will be observed between the soft and rather spongy wood pro-

§ "Le Greffage Pratique de La Vigne," by V. Vermorel.

duced by the vinifera scion, which constitutes the right hand part of the photo, and the denser though less abundant wood of the resistant stock on the left. The very intimate union between the two is clearly shown.

It must be remembered that callus only forms under certain conditions of temperature and moisture. As pointed out by Professor Bioletti,* the formation of callus is very different from that of roots. The latter form more freely if the soil contains 15 per cent. of moisture; callus, on the contrary, is most abundant in sand which only contains 5 per cent., and it is nearly as plentiful with only 2½ per cent. This fully explains the evil effects of an excess of moisture during the knitting period which have been already pointed out. Callus does not form at all under water.

As regards temperature—at 68 deg. F. there is very little callus formation at the end of eight days; at 77 deg. it is plentiful, and still more so at 86 deg. The temperature of 77 deg. is the one which has been found most suitable in the artificial callusing of bench grafts, as practised at the Wahgunyah nursery. It is of course impossible to insure an even temperature in the case of field grafting; there must necessarily be considerable difference between day and night. This, however, does not seem to be of any consequence. It will readily be understood that the bigger the mound, the more even will the temperature be in the neighbourhood of the graft. In the case of a large mound, it will not become too hot during the day time, and will take longer to cool down during the night.

* Bulletin No. 180, University of California. Resistant Vineyards, by Professor F. Bioletti.

Be very particular in preparing barley for sale. It must be sorted and cleaned with the best machinery for the purpose. Mix only such barley as is quite uniform in character and quality. Mixed grain of different quality possesses little value, and the addition of poorer quality to a higher diminishes the latter quite out of proportion to any advantage gained by the extra bulk. Musty, poor-coloured grains, even in small quantities, will spoil a large bulk of otherwise excellent grain.

The amount that each horse will eat will depend largely on the horse. About 1 lb. for each 100 lbs. of horse is considered by some good feeding of roughage, and many think a like weight of grain feed plenty. Some horses require more. Maize and oats, half and half, might be a good grain mixture to use. Start the horse on a moderate ration, and increase to the maximum gradually. Three gallons of grain fed to each daily, and the hay as cleaned up, with perhaps a pound of oil cake added, should be ample.

SCIENCE AND PRODUCTION.

At the Royal Society of Victoria, Mr. A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent, gave an address on "Science and Production."

Mr. Richardson said:—"Professor Ewart, the Secretary, asked me to give an address to the members of this Society on 'Science and Production.' This subject, however, presents so many phases that it would be impossible to do it justice in the brief time at my disposal. I purpose, therefore, to confine my remarks to the consideration of (1) some typical cases in which science has assisted agriculture, (2) some agricultural problems awaiting solution, (3) methods that might be adopted to assist agricultural production."

Science and Agriculture.

First consider a few cases illustrating the effect of simple scientific discoveries in increasing the volume of agricultural production, choosing the illustrations to suit the phases of agriculture to be seen in this State. One of the most interesting cases is the far-reaching effect of the discovery by Liebig that the insoluble tribasic phosphate as found in bones and natural rock phosphates could be converted into the water soluble phosphate by treatment with sulphuric acid. Liebig, in his report to the British Association in 1840, suggested that this would be a suitable form in which to apply phosphoric acid to crops.

Sir John Lawes, of Rothamsted, was one of the first to profit by this discovery, for he not only tested the efficacy of the dissolved bones in his famous experimental plots, but began the manufacture of superphosphate from rock phosphate in 1842, and thus laid the foundation of a large fortune, which he subsequently made and devoted to agricultural research. Since then the practice of using superphosphate has spread to every agricultural country in the world. These water soluble phosphates are very popular in Victoria.

In 1914, 118,000 tons of superphosphate were manufactured in Victoria, and no less than 3,400,000 acres were manured with super. At a conservative estimate, the application of each cwt. of super. applied to the soil would affect an increase in the yield of wheat of at least 6 bushels, worth £1; hence Liebig's discovery is worth annually £500,000 to the artificial manure trade, £2,000,000 to the farmers, and at least £150,000 to the Railway Department for increased carriage of produce, or a total of £2,650,000.

Superphosphate has been applied to wheat lands for over twenty years in Victoria, but it is only within the last seven years that the use of super. has become general, and even now a large percentage of the farmers are not making the most effective use of this fertilizer. The average amount of super. used in the State is 56-60 lbs. per acre for wheat. Experiments at the State Farms for the past four years have conclusively demonstrated that 1 cwt. per acre gives a much more profitable return than a dressing of ½ cwt. per acre.

This is illustrated in the following table:—

Table Showing Net Profits per Acre from Light and Heavy Dressings of Superphosphate over Unmanured Plots at Werribee, Rutherglen, and Longerenong, for the Three Seasons 1913-1914-1915.

Plot.	Average Yield for three Centres.	Increase over no Manure Plot.	Value of Increase at 3s. 4d. per Bushel.	Cost of Manure.	Net Profit per Acre over no Manure.
	Bushels.	Bushels.			
No manure ..	13·2	..	..	..	..
½cwt. super. ..	18·9	5·7	£0 19 0	£0 2 6	£0 16 6
1cwt. super. ..	20·9	7·7	1 5 8	0 5 0	1 0 8
2cwt. super. ..	21·3	8·1	1 7 0	0 10 0	0 17 0

Similarly with other crops—lucerne. There are 71,000 acres of lucerne in the irrigated settlements of the State. Some of this lucerne has been recently planted, but the greater portion of it has been planted for 3-8 years. A great deal of it, probably the greater part of it, has never received a dressing of artificial fertilizer since the day it was sown. A series of tests conducted over a period of two years at the State Research Farm, Werribee, showed that the application of 2 cwt. of fertilizer per acre, costing 10s., resulted in an increase of 35 cwt. of hay over the non-fertilized portion—an increase worth £4 7s. 6d. per acre—thus showing a net profit of £3 17s. 6d. per acre.

The land in the irrigation settlements is very similar to Werribee. Tests made at Wyuna show the same relative increases. If this increase could be applied to the 70,000 acres of lucerne in the State, it would mean an increased production worth over a quarter of a million sterling.

Development of the Sugar Beet Industry.

Another interesting illustration of the value of scientific work in assisting agriculture is the improvement of the sugar content of the beet. It will be remembered that the beet sugar industry was established by Napoleon as a movement hostile to England. He closed European ports to British trade, and thereby cut off the supply of sugar. In 1807, at the time of the establishment of the sugar beet industry, the average content of the roots was 6-7 per cent. In 1813 there were 313 factories in France, each having a capacity of 10½ tons per annum. After Napoleon's overthrow the young industry nearly died out, but under the stimulus of bounties it made rapid strides, and now it furnishes two-thirds of the world's sugar.

This remarkable result has been largely brought about by the great improvements effected in the sugar content of the beets by systematic selection, whereby the average sugar content of the beets has been raised from 7 per cent. to 18.5 per cent sugar.

The history of the improvement of sugar beet may be divided into three stages. In the first period, from 1838 to 1868, the improvers of seed confined their attention almost entirely to physical characters, such as form. During this period medium-sized, shapely roots were selected, as it was noted that the largest roots were always poorest in sugar. From

1838 to 1870 the increase in the average percentage of sugar in the roots was small, namely, 8.8 to 10.1 per cent. During the second period (1868 to 1888) Vilmorin's discovery that, although the sugar content of the beet was an hereditary character, it is necessary to repeat the selection of seed-bearing plants at frequent intervals in order to maintain the improvement.

To ascertain the richness in sugar of the mother plants, Vilmorin floated the roots in baths of salt or in sugar solutions of known specific gravity. This method was replaced by a process of analysis of small sections of the roots by means of the Polarimeter.

These methods were used by Vilmorin with great success between 1870 and 1888, and during this period the average content of the sugar beet rose from 10.1 to 13.7 per cent. The final stage of improvement of the sugar beet was begun when the breeder took into account the ancestral heredity of the mother plants. The method consisted in valuing the different reproducing plants separately, keeping the seeds produced by each apart, and determining by direct experiment the faculty of transmission which each plant enjoyed.

Occasionally the breeder meets with roots the characteristics of which are abnormally desirable. Such plants are subjected to careful genealogical selection in order to ascertain whether their descendants show these desirable qualities on an even greater scale. If so, these roots are made heads of families and the starting points of new and improved races. By these methods of individual selection, controlled by chemical analysis, the average sugar content of the beets has been raised from 15.2 per cent. to 18.5 per cent. As individual roots contain up to 26 per cent of sugar, there is every reason to believe that the limits to improvement have not yet been reached. The application of the above methods of selection has improved the sugar content of beets to such an extent that it is now possible for sugar grown by white labour from sugar beet to compete on equal terms with sugar grown from cane by black labour in the tropics.

Phylloxera.

Now consider the interesting illustration of the part played by science in the viticultural industry. In 1863 there were rumours of a mysterious disease on the vines in the Bordeaux district of France. It proved to be the terrible scourge of the vine—phylloxera. It rapidly spread through France, and in twenty years (1884) no less than 2,500,000 acres of vines were absolutely destroyed. The total damage due to the ravages of this pest amounted to £400,000,000—twice the amount of the war indemnity paid by France in the Franco-Prussian war. From France it spread through Europe, Africa, and, finally, to California and Australia.

It broke out in Geelong in 1877, in Rutherglen in 1898, and it has destroyed about 30,000 acres in Geelong, Bendigo, and Rutherglen.

That will give some idea of the disastrous effect of phylloxera. It may be explained that phylloxera is an American insect found east of the Rocky Mountains, and is classed among the aphides. It lives on the leaves of the American vines, and causes curious galls on the leaves.

A feature of the life-history of the pest is the remarkable power it has of multiplying asexually, *i.e.*, by Parthogenesis. In its life cycle many generations of parthogenetically produced progeny are formed, and this accounts for the enormous rate at which it sweeps through a country.

The French Government sent a scientific commission to America to study the pest on the spot. This commission systematically examined the whole problem, and came to the following conclusions:—

1. The phylloxera rarely, if ever, attacked the leaves of the European vines.
2. Phylloxera formed galls on the leaves of American vines, but the roots were immune from attack.
3. Therefore, if the European vines were grafted on the roots of an American vine, the resultant plant would be immune from attack.

A great deal of work had to be done to decide which varieties of American vines would act as the best stocks. After a great deal of systematic experimental work, Riparia and Rupestris were selected as the best stocks. Riparia was ultimately thrown out, because though resistant it was not lasting.

Hybridization was also used as a method of creating new types of vines that would be immune from attack. Rigorous selection was applied to these crossbreds, and each hybrid had to pass four tests. They had to be—

1. vigorous,
2. resistant to phylloxera,
3. adaptable to the soil for which they were required, and
4. possess affinity, *i.e.*, ability to carry different scions.

Only very few survived the test. Thus, out of thousands of Rupestris crosses only two were selected as thoroughly satisfactory stocks, namely, 3306 and 3309. These are now largely used in Europe as resistant stocks.

The Babcock Test for Butter Fat.

The simple method formulated by Dr. Babcock, of the Wisconsin Experiment Station, for determining the fat content of milk and cream has changed the outlook of the dairying industry. Not only has it enabled butter factories to use an exact method for payment of milk and cream according to quality of the product, but it is of incalculable value in improvement of the dairy herds of the State.

A new standard for breeding is placed before every dairyman—the breeding of cattle that will produce the highest quantity of butter fat per annum, and not merely the highest quantity of milk. The simple and rapid method of determination of the fat percentage of the milk provides the dairyman with a means of detecting the unprofitable members of his herd, and enables him to build up a herd of efficient butter fat manufacturers. The motto of the dairyman should be, "Breed, feed, weed." Breed from the best types of cattle. Feed them well, for, after all, the cow is in essence a milk factory transforming the raw material—food—into milk. Weed—that is, ascertain the quantity of butter fat produced by each individual for the year, and cull out those below the standard. Herd testing will bring about a great revival in the dairying industry in Victoria, and a firm scientific basis for herd improvement has been provided by the discovery of the simple method of determining the fat content of a sample of milk.

Federation Wheat.

Most important of all is the progress made possible by the recent discoveries in genetics. In 1901, just at the time De Vries, Correns,

and Tschermak independently re-discovered Mendel's law, William Farrer, a Cambridge graduate, working as a wheat specialist in New South Wales, finally fixed a new variety of wheat—Federation—that was destined to become the most popular and profitable variety of wheat cultivated in Australia. So popular has Federation become that Farrer may be said to have changed the colour of our harvest fields from golden yellow to dull bronze—the colour of his own Federation wheat.

It is difficult to estimate exactly what the introduction of Federation has meant to Australia. So far as Victoria is concerned, we would be well within the mark in saying that during the last five years the increased yield due to Federation wheat is at least 1 bushel per acre, or approximately, £500,000 per annum. Not only did Farrer succeed in producing the most popular and prolific variety in the Commonwealth, but he also produced two of the best milling wheats in the world—Bobs and Comeback—as well as a host of other varieties suited for special districts.

Agricultural Problems Awaiting Solution.

A glance at the isohyets of rainfall for Australia will convey a good impression as to the future possibilities of the island continent. The 10-inch and 20-inch lines of rainfall divide the continent into three concentric belts of approximately equal area.

The outer belt—what may be called the dairying belt—has a rainfall of 20 inches or more. In this area the rainfall is sufficient to permit intense forms of agriculture to be practised—dairying, fruit culture, root crops, market gardens.

The intermediate zone, except north of the tropics, corresponds to the wheat belt, whilst the inner zone of lowest rainfall is the pastoral area

There are, approximately, 600,000,000 acres in each of these three divisions. Of these three belts the most interesting is the intermediate zone, with a rainfall of 10-20 inches per annum. It is in this belt that the greater portion of the wheat is grown. The accompanying map shows the area under cultivation in each district compared with the total area. It will be seen that only a very small proportion of the area is occupied by crop

A feature of the agricultural development of Australia during the last fifteen years has been the gradual extension of the cultivation into areas that a generation ago were considered too dry for successful farming.

Ten years ago it was considered that the 15-inch line of rainfall was the limit beyond which wheat-farming was a gamble. Now, land with an average rainfall of 10 inches has been successfully worked in South Australia. The problem of pushing the limits of the wheat belt beyond its present confines is the most fascinating ever brought before an agricultural community. Every 10 miles we can push back the present margin means a new province of 15,000,000 acres added to four wheat States of Australia.

What are the factors for the successful utilization of these areas? —(1) More efficient farming methods, (2) the use of suitable varieties of wheat.

Note first that the greater part of the rainfalls in the growing period from April to October, *i.e.*, at a time when the evaporation is small and the rain is most efficient. In Victoria about 70 per cent. of the rain

falls in the winter months, whilst in Western Australia the winter rain is as much as 85 per cent. of the whole.

There are four factors which have assisted in pushing back this margin of cultivation—

(1) Improved cultivation methods, particularly the practice of fallowing, combined with thorough cultivation of the soil.

(2) The use of superphosphate, which gives the young plant a start, encourages deep rooting, and makes the available soil moisture more efficient.

(3) The introduction of labour-saving implements, which get over a large area of ground in an efficient and economical way.

(4) The use of varieties of wheat specially suited to arid districts.

Fallowing is essential in these arid localities. The amount of rain in one year is not sufficient to grow a heavy crop; but by fallowing, combined with careful working, one can make available the rainfall of two winters for the use of the one crop.

Experiments conducted at Longerenong, Rutherglen, and Werribee show that it is possible, by careful cultivation, to carry over from one season to another at least 4 inches of conserved soil moisture in the first 3 feet of soil. This quantity is sufficient, if it is all passed through the plant, to grow an extra 10-12 bushels of wheat per acre.

Superphosphate has been a most useful adjunct in these areas. Sown with the seed, it encourages deep rooting and rapid growing. It makes the soil moisture more efficient by increasing the concentration of the soil solution with respect to the most deficient plant food element, and, therefore, lowering the transpiration ratio of the crop, *i.e.*, the amount of water required to elaborate 1 lb. of dry matter.

Wheat for Arid Districts.

The most important factor of all has been the growth of varieties particularly suited to the drier districts. The ideal wheat would be that variety which elaborated the greatest quantiy of grain per nuit of water consumed.

There seems to be very little difference in the transpiration ratio for the different varieties of wheat as expressed in dry matter. An examination of six varieties in the pot culture house at Rutherglen last season showed that to produce a ton of dry matter in Yandilla King variety 209 tons of water were required, whilst to produce the same quantity of dry matter in Huguenot 243 tons of water were required. But when we consider the quantities of water required to produce 1 ton of grain we find remarkable differences, because the different varieties of wheat differ very much in the amount of grain they produce, compared with the dry matter.

The ratio of the amount of grain produced compared with total straw is called by Beaven the migration ratio. In a series of tests at Rutherglen it was found that Yandilla King was able to produce a ton of grain for every 560 tons of water used, *i.e.*, 6.4 inches of rain. Federation required 750 tons, whilst Huguenot required 1,081 tons, and Kubanka 1,188. This is an interesting illustration of the efficiency of the two varieties which are used in the drier districts of the State.

To secure the most suitable types of wheat for the arid conditions, two factors should be especially considered—

1. Low transpiration ratio, particularly for grain. These are characterized by sparse stooling, short-strawed varieties, containing a large percentage of grain compared with straw.
2. Early maturity, so that the variety may be well on to maturity when the first hot winds set in.

There are three ways of securing these—

1. *Acclimatization.*—Scouring the earth for types accustomed to grow for generations in an arid environment, and testing these types in each of the climatically different districts of the State.
2. *Selection.*—Selection from existing types varieties which show in the highest degree the special characters we are seeking.
3. *Crossbreeding,* and the production of new types containing in the one variety the desirable unit characters from several varieties.

   This is now an important phase of the work of the Victorian Department. At Werribee and Dookie a large number of new crossbreds at all stages of growth are undergoing trials in competition with the best of our local varieties, and the results already obtained suggest that new and prolific varieties, adapted to the drier districts, can be produced with a fair degree of certainty.

So much for the problem of pushing back the margin of cultivation. It will be solved by the general adoption of better methods of farming, increasing the acreage under fallow, the use of superphosphate, but most of all by the production of hardy varieties of wheat.

Increasing the efficiency of the areas already under cultivation. This is even more important than the former, because on it rests the possibility of keeping the agricultural community permanently prosperous. It is of more importance to a State like Victoria—the most densely populated of all the States in the Commonwealth. Here, future prosperity depends, not so much on the multiplication of acreage under crop as on increasing the production per acre.

Top-dressing Pasture Lands.

First consider the grazing or pasture lands of the State. These, according to the *Year-Book*, occupy an area of 32,000,000 acres out of a total of 37,000,000 acres. These pasture lands are the areas on which the normal carrying capacity of 12,000,000 sheep and 1,500,000 cattle of the State are grazed. Approximately, two-thirds of these lands are in districts of fairly heavy rainfall, *i.e.*, 20 inches and over.

Experiments on the top-dressing of pastures carried out by the Department for the past four years show that the stock-carrying capacity of ordinary grazing land can be increased from 50 to 100 per cent. by the application of suitable combinations of phosphates and lime.

Australian soils are noted for their deficiency in phosphoric acid, and many of our Victorian soils, especially in Gippsland, are deficient in lime. Top-dressing of natural pastures with dressings of phosphates and lime is practised by an occasional land-owner. There are no figures available as to the extent to which pastures are top-dressed, but it is safe to say that 99 per cent. of the area is not treated in any way by the land-owners.

Increase of the Acreage under Fodder Crops.

No material increase in the numbers of our flocks and herds can be brought about unless more attention is paid to the growing of forages for stock. Generally speaking, the amount of stock food that can be raised per acre by cultivation is at least five times that afforded by natural pasture. To permanently raise the numbers of stock kept in the State it is necessary to speed the plough—to devote an increasing acreage to such forage crops as barley, rape, pease, lucerne, millet, &c. Hitherto the tradition of the Australian past has governed our actions—that the sheep is an animal which will only pay when fed on grass.

The results of experiments at Werribee and Rutherglen show conclusively that in districts with a rainfall of 20 inches or over, the growing of fodder crops for feeding down to sheep is much more profitable than the wasteful system of bare fallowing. Moreover, the stock-carrying capacity of the farm is increased and the fertility of the soil is conserved —results of great importance from a national point of view.

Increase the Fodder Reserves.—The strength of a chain is measured by the strength of its weakest link. In view of the occasional droughts which affect Australia, the numbers of the flocks and herds that can be kept will depend on the amount of fodder conserved to meet the seasons of low productivity.

Rainfall records over long periods show that portions of Australia, like many other countries, are occasionally affected with dry seasons and partial or complete crop failures. Fortunately, these droughts are not frequent, but in the past they have always been associated with heavy stock losses. A policy of deliberate conservation of fodder supplies—hay, silage, and straw—conservation of water supplies, and extension of water storages and irrigation facilities will alone enable the State to fight a drought, and mitigate, if not entirely prevent, the losses of stock which are the worst feature of droughts.

Extension of Irrigation.

As Victoria must look for future agricultural expansion in the direction of intensive culture rather than multiplication of acreage, it follows that the extension of irrigation and the increase of water storages should be systematically accelerated. Irrigated agriculture, with its certainty of control over soil and crop, has infinitely more possibilities than dry farming. Twelve thousand acres of irrigated land at Mildura support a population of 6,000 souls, and brings in an aggregate revenue of half-a-million sterling. Similar land devoted to wheat growing under dry farming would not support much more than twenty families.

When all existing streams in Victoria are harnessed, 750,000 acres, possibly 1,000,000 acres, will be devoted to irrigation. The main factors for success in settling such an area are—the acquisition of suitable land at a reasonable price, settlers with suitable experience and sufficient capital, the building up of a systematic body of irrigation knowledge to guide the settlers to success, and adequate and stable markets for irrigation products.

Development of Smaller Industries.

Victoria offers, by reason of its soil and climate, and its comparatively dense settlement, good opportunities for the successful establishment of industries which have not yet secured a firm hold in Australia. In this

connexion, flax, tobacco, and sugar beet may be mentioned. It is admitted that our soils are eminently suited for these products, but hitherto labour difficulties have been the chief cause of their non-success. Tariff adjustments, or the adoption of adequate bonuses are probably the best way to firmly establish these industries, as it has been amply demonstrated that the soils and climate in various parts of Victoria are quite suitable for the growth of such crops to perfection.

General Increase in Efficiency.

A general increase in efficiency is urgently required in all branches of primary production. Our average wheat yield could certainly be raised to 20 bushels per acre in favorable seasons, and we could at least secure a 16-bushel average over a ten-year period if all the resources of production were fully and properly used.

By systematic effort, by adequate feeding and herd testing, the average yield of the cows of Victoria could be raised by at least 40 to 50 per cent. A change is gradually coming over our farming community, and finding expression in the desire for more technical knowledge, greater interest shown by farmers in experimental work, a keener appreciation of agricultural literature, and an eagerness to secure the most up-to-date and efficient farm implements.

Lack of capital is an important factor in retarding agricultural progress. The difference between the successful and unsuccessful wheat-grower is frequently due to the superior technical agricultural knowledge of the former, but is often due to the want of capital crippling enterprise on the part of the unsuccessful grower.

With capital available for the development of the farm, and increased technical agricultural knowledge, the agricultural future of Victoria is assured.

IMPROVEMENT OF WHEAT AND OTHER CROPS BY SEED SELECTION.

The Agricultural Department and others in various parts of the world have demonstrated that, without doubt, very considerable improvement can be made in the quality and yield of many of our staple crops by the adoption of a system of seed selection, which could, and should, be carried out over a period of years, and, in fact, indefinitely, to attain the best possible results.

Such systems are general in their application to live stock in the building up of stud flocks, but little is done in this direction by the individual grower of cereals and other crops.

This may be due to the fact that no good and simple system has been commonly known by which such improvement can be brought about.

At present the most up-to-date farmers grade their seed as a step in this direction, but more is necessary. As seed is sown under present conditions, inferior plants are given the same advantages as the better plants, which as a rule are in the minority, consequently after a few years the seed deteriorates, and a change is rendered necessary. An

improvement in yield of at least 20 per cent. to 50 per cent. may be expected as a result of the system laid down by Mr. A. E. V. Richardson, which is as follows, and which involves little labour, but should be carefully carried out in detail:—

Method of Improvement.

The method proposed is to apply the same principles to the improvement of wheat as have hitherto been applied to the improvement of stock, choosing the seed only from the best individual plants. An ordinary crop of, say, Federation wheat consists of a mixture of high yielding plants, average yielding plants, and low yielding plants. When we harvest such a crop with the harvester the seed obtained is of average yielding capacity, is no better, if as good, as the seed which produced it.

If there were some means of isolating the prolific plants and growing the seed from these plants, we would find that the yielding power of the seed from these plants would be considerably increased, according to the judgment displayed by the operator.

One way of isolating these high yielding plants is to go through a crop just before harvesting and select the best developed and most compact heads from the best developed plants. These heads are threshed, the seed then graded and sown on a plot. Such a plot, because it consists of specially selected seed, is called a "stud plot."

A convenient size for such a plot is one-fifth of an acre. To get sufficient seed for such a plot about 25-30 lbs. of heads would be collected. This represents not more than a half-day's work. These heads are threshed, and graded either with sieves or a blower, so that the undersized grains are removed.

Experiments have shown that the heavier grains of wheat on the whole produce the best crop, so that the use of a blower would be advisable.

This plot should be sown on well-fallowed land, with an amount of superphosphate not exceeding 100 lbs., in 1917.

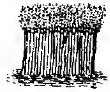
Before the stud plot of 1917 is harvested preparations for the second year are made. Another 24-30 lbs. of heads are selected for the second year—the heads this time being taken from the stud plot instead of the general field. The same procedure of threshing and grading the selected heads is carried out, and the stud plot is sown as before on a fifth of an acre in 1918. This stud plot of 1918 has two years' selection behind it—selection of the best from the best.

The produce of the 1917 stud plot is harvested, the seed graded and sown the second year (1918) on as much land as the seed available will permit. In an average season there should be sufficient graded seed from the stud plot to sow at least 2½-4 acres. This plot we may call a "seed" plot. It is better seed than the main crop of the farm, but it is not quite as prolific as the "stud plot."

In the second year, therefore, there will be two plots—a stud plot of one-fifth of an acre, and a seed plot of 2½-4 acres.

At the 1918 harvest. As before we have to get the seed for the "stud" plot by again selecting the best heads of the 1918 stud plot. The seed plot of 2½-4 acres will be sown from the balance of the 1918 "stud" after the selected heads have been taken.

The seed plot of 1918 will be harvested, and sufficient seed should be obtained to sow about 30 acres in 1919.

1916 

Crop of Wheat, 1916

Go through this and select sufficient well formed heads to sow a stud plot in 1917.

1917

No. 1 — 1-5th acre — Stud Plot

In 1917 each selector will have a stud plot of not less than one-fifth of an acre with a space 3 feet wide round it. When this crop is ripe (Dec. 1917) enough selected heads are taken to provide for the stud plot of 1918. The harvester is then run over the crop and the seed used for the seed plot of 1918. (Diagram.)

The best heads of No. 1 are selected for No. 2.

The balance of the plot is sown here.

1918

No. 2 — 1-5th acre — Stud Plot 1918

No. 3 — 2½ to 4 acres — Seed Plot

In 1918 (the second year) the selector will have these two plots—Nos. 2 and 3. (Diagram.)

The best heads from No. 2 are sown in No. 4.

The balance of No. 2 is sown here.

The produce of No. 3 is sown here.

1919

No. 4 — 1-5th acre — Stud Plot

No. 5 — 2½ to 4 acres — Seed Plot

No. 6 — 25 to 40 acres — Bulk Plot

In 1919 the selector will have three Plots.

BEE-KEEPING IN VICTORIA.

By F. R. Beuhne, Government Apiculturist.

XXVI.—THE HONEY FLORA OF VICTORIA.

(Continued from page 41.)

GRASS TREE (*Xanthorrhœa.*)

Erect, usually robust plants with narrow, very long, rigid, and comparatively thick leaves and upright flower spikes with numerous

Fig. 62.—Grass Tree.

whitish flowers. There are three species, two of which are widely distributed over the State, while one, the Spear Grass Tree, is confined to the far east of Victoria.

Southern Grass Tree (*Xanthorrhœa australis*).

(Fig. 62.)

This is the Common Grass Tree known by several local names such as Black Boys or Kangaroo Tails. It has a trunk like a fern tree, but with long, narrow, drooping blades or leaves. The usually solitary flower spike, which is sometimes up to 3 feet long is carried on a stout upright stalk. Grass Trees furnish a resin soluble in alcohol, containing the base of picric acid. This resin, which exists in this species in considerable quantities, is very inflammable, and grass trees therefore burn fiercely, are however seldom killed by fire, and flower generally speaking, only after being burnt the previous season.

Bees gather the resin eagerly and use it as propolis for filling cracks and the spaces between the ends of the top bars of the frames and the hive wall. During cool weather this resin sets so hard and cementlike that the frames become almost unworkable, while, during warm temperatures, it adheres to everything coming in contact with it. Being soluble in alcohol it is however easily removed from the hands by methylated spirits or petrol.

The flower of the grass tree furnishes pollen to bees, and profusely secretes a very watery nectar, often neglected by bees, which when gathered produces a rank unpalatable honey. Except in seasons when no other nectar-yielding blossoms are available, grass-tree country should be avoided in locating apiaries on account of the trouble of the glueing together of everything in the hive and of the poor quality of the honey.

Small Grass Tree (Bayonet Grass) (*Xanthorrhœa minor*).

(Fig. 63.)

The well-known, rough, tussocky grass, found on usually sour soil with a clay subsoil, all over the State, except in the North-East. Like the Grass Tree it flowers only after burning. The flower spike is smaller but often quite a number spring from the same plant. The leaves are unpalatable to animals, excepting the underground, soft, white portion, which, in times of food scarcity, is pulled out by kangaroos, scratched out by rabbits, and also eaten by stock when the tussocks are uprooted by the stock-owner, when forage is scarce.

The flower yields pollen, and is a valuable help to the bees in drought seasons when pollen is scarce. The nectar is watery, and sometimes secreted so freely that it can be shaken out of the blossom into the palm of the hand. Like the nectar of the Grass Tree it is sometimes neglected, possibly on account of the extreme dilution.

Small Grass Tree also contains resin, but as the base of the plant is underground and only accessible to bees when uprooted it does not cause trouble with propolis in bee-hives.

Spear Grass Tree (*Xanthorrhœa hastilis*).

This is confined to the far east, and up to the present nothing is known as to utility for bee-keeping.

TEA TREE (*Leptospermum*).

A group of shrubs which are seldom dwarf, and sometimes assume the dimensions of small trees. The leaves are small, scattered, the branchlets sometimes crowded. The open five-petalled white, or

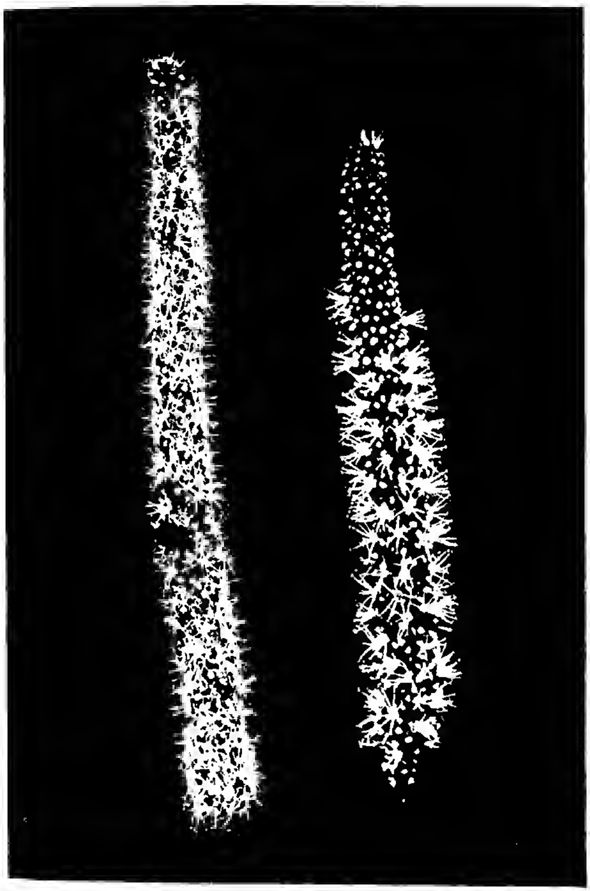


Fig. 63.—Bayonet Grass.

sometimes pinkish, flowers are mostly stalkless, the fruit three or more celled.

There are seven distinct species in Victoria, some of which are variable in the size and shape of leaves and flowers, making differentiation

somewhat difficult. All the species have one characteristic in common, namely, that the flowers generally secrete nectar very freely, which, when transformed into honey by the bees, is in colour about the darkest Victorian honey, has a strong, rank flavour, and, as it sets like jelly in the cells, it cannot be removed from the combs in the extractor. It is quite unsuitable for marketing as table honey, although people living in tea-tree country, and getting it out of their own hives, become used to it, and even like it. One use to which this honey can be put is in the manufacture of plug tobacco, for which purpose some quantity of honey is used annually. When newly-gathered tea-tree honey is quite thin, but as soon as it has reached a certain degree of density it sets into a jelly-like condition, and the evaporation then ceases, so that it always contains a higher percentage of water than others of our honeys. After removal from the combs, which can only be done by pressing or melting, it often partially candies with a very coarse grain.

In the locating of apiaries for the commercial production of honey it is best to keep away from tea tree belts, but in seasons when other sources fail bees can, with advantage, be moved on to tea-tree country. Notwithstanding its unpleasant flavour and jelly-like texture the honey is excellent bee food, and as the flower of the tea tree yields pollen, as well as nectar, thus encouraging brood rearing, the colonies are therefore always in good condition.

The tea-tree flavour is in Australia often erroneously called "eucalyptus flavour," while what in Great Britain is known as the eucalyptus flavour of Australian honey is what we here so much appreciate as the "box tree flavour."

(To be continued.)

THE CONTROL OF MAMMITIS.

By M. Thomas, Dairy Supervisor.

Cleanliness in dairy management is a far more directly important matter to the dairyman than most of those following the business think.

The number of owners of dairy herds who are as strictly attentive to all sanitary detail as they should be is comparatively small.

Officers of the Dairy Supervision Branch have been for years past advising and instructing dairymen to cultivate higher standards of dairy sanitation. Although most of the cow keepers respond to the efforts of these officers in a greater or lesser degree, many of them appear unable to maintain a highly satisfactory condition without fairly constant supervision.

Cleanliness to the degree sought by this Department is still erroneously considered by many dairymen as making unnecessary work, and increasing the worries of a business already too well supplied with them. There is, however, nothing of the faddist in the supervisor, and the advice is given for reasons that are most practical.

Cleanly dairy management is not only very advantageous to the consumer, in that the produce used by him under such conditions will be of good keeping quality, appetizing and health promoting; but the health of the cattle themselves is very largely controlled by their sanitary surroundings. Diseases of a contagious nature are very often checked and controlled by cleanly methods in the milking sheds and yards, but dirty and careless habits help to spread them.

Take mammitis, for example, probably no notifiable disease under the Dairy Supervision Act, not even that insidious one tuberculosis, has spread to such an extent through the dairying herds of this State as mammitis, or garget as it is commonly known, nor caused such monetary losses to the farmer as this disease has done.

This may at first appear a rather startling statement; but it is warranted by several years' experience in handling cows in different parts of the State. As showing the prevalence of this disease among the dairy herds during a recent examination of dairy cows in one district alone, when 1,457 head of milking cows were handled, no less than 117, or 8 per cent., of these were found to be affected with mammitis in some form. This number, possibly, is not so large as usual, owing to the high prices obtainable for beef cows, and the good year for grass being a favorable opportunity to dispose of numbers so affected at a high price to graziers.

And when we consider that the number of cows stated above, found to be affected with mammitis, was the result of only one inspection, some idea may be gained of the probable extent to which the disease exists in the herds of the State.

Although the disease and its treatment have been brought under the farmers' notice by Mr. R. J. de C. Talbot, B.V.Sc., in an article on mammitis, in the May issue, 1913, of the *Journal of Agriculture*, the seriousness of the situation is still very far from being realized by them. If they could only be brought to consider the loss the disease is causing them individually, that article would be read and studied carefully by every farmer, for its value is inestimable. This might result in the annual loss from this disease being considerably reduced.

Dairymen, in many cases, are totally ignorant of the causes of mammitis, and owing to the many forms in which it appears they find it hard to distinguish them as variations of the same disease. It frequently happens that they are so satisfied with their own faulty diagnosis of the trouble that they give little heed to professional advice, and consequently the affected animal receives no treatment, and therefore seldom makes a recovery. If dairymen will fix their attention to the fact that mammitis is fundamentally an affection of the udder, they would arrive more quickly at the reason for their cows' sickness.

Although the udder may have been affected some time, they usually do not notice any sign of the disease until some very pronounced condition occurs. If this should be confined to an inflamed condition of the udder, accompanied with heat and pain, then they may diagnose it and treat it reasonably well; but if, as frequently occurs, the animal also shows signs of sickness, such as a feverish condition, staring coat, lameness, &c., the owner will more often than not diagnose the

trouble to be anything but what it really is, *viz.*, a typical case of acute mammitis. Again, although they may notice in the milk-strainer a small clot of what appears to be curd, they never think for a moment to connect this trifling matter with mammitis, although it should at once be recognised as a danger signal to warn them of the disease, and every care should be taken to combat it in its earliest stages. If on drawing the fore-milk from a cow's teats it be found to contain clots, the cow should be isolated, and treated for mammitis, as advised by Mr. Talbot.

Many cows have been found to have their milk clotted for some time, then apparently became normal, and later on became clotted again. These cows, where they were not treated, invariably became utterly useless as milkers, although in some cases it took more than a year to justify their exclusion from the herd.

In a large herd, where several milkers are straining milk into the same can, it is harder to detect a cow that is only occasionally showing clots in her milk than it would be in a smaller herd, where only one or two were milking the cows. Nevertheless, no effort should be spared to discover her. This can be done by examining the fore-milk drawn from each teat, milked on to the palm of the hand; the clots, if present, will generally stick to the hand. If this fails, each cow's milk should be strained separately, until the one sought is discovered. No cow's milk that is showing clots should be mixed with the bulk milk, and the precaution of separately straining each cow's milk before mixing should be observed in a herd where mammitis is suspected. The careful owner will take no risks by considering it is only a temporary trouble that will right itself; but will at once resort to the treatment for mammitis, or else engage the services of a veterinary surgeon to treat the case.

Too much emphasis cannot be placed on the advice to isolate the affected cow, disinfect the hands of the milker, buckets, sheds, &c., and also to destroy all milk from an affected udder. This latter is very important, as sometimes a milker will throw the purulent matter from an affected udder out over the yard fence, and let it lie there for the flies to inoculate other members of the herd. This is one of the occasions where the dirty and careless dairyman brings trouble to himself.

Even the cows suspected of having mammitis should be kept by themselves, and always milked last of the herd.

The milk from an affected udder should never on any account be used for household purposes. Professional men have no hesitation in saying that the consumption of milk from cows affected with mammitis is a great danger to infant life, and is possibly the cause of many of the bowel complaints of young children.

People frequently continue to use the milk from a cow that is only affected in one quarter, in the belief that the rest of the milk is clean and wholesome. There is, of course, the bare possibility of this being so; but when we consider the serious results that may happen through the consumption of milk that is contaminated, it is evidently very unwise to risk people's health for the sake of pecuniary gain.

To show the bearing that cleanly methods of handling cows may have on this disease, in one herd where it was found to be causing

much loss, the cows were being milked in a clean, well floored and drained shed, but were paddocked at night in a small paddock where there was a considerable accumulation of manure. This was altered by turning the cows into another paddock, where there was clean grass to lie upon, and from that time the number of cows freshly affected was considerably reduced, and the spread of the disease checked.

Thus we see that too much care and attention cannot be given to the keeping of everything connected with dairying clean and tidy. A sure means of conveying mammitis from one cow to another is to use only the one can of water to wash all udders, as is also the dirty milker who allows the slime to accumulate on his hands. Spilt milk lying about, or any filth, is a great attraction to the flies, and these may carry the disease from cow to cow.

As regards the loss that mammitis is causing annually to the dairying industry, an estimate can only be approximate; but if the proportion found to be affected in the district previously referred to were maintained throughout the State of Victoria, the amount would be a large one.

Before the drought, 1914-15, there were 610,500 dairy cows milking in the State; 8 per cent. of these would be 48,840 cows affected with mammitis.

The loss sustained by the dairying industry through these cows being unfit for the production of wholesome milk, may be computed at £5 per cow.

This would mean £244,200 lost annually to the industry, to say nothing of the loss of the cows which are sold for slaughter on account of the disease. In view of the taxation that must inevitably accrue as a result of the great war we are carrying on at present, can the farmers afford any longer to neglect these important matters, and allow this great leakage to occur?

HINTS ON THE SEPARATOR.

By J. W. McKenzie, Dairy Supervisor.

Considerable loss occurs in separating upon many dairy farms as a result of inattention to important details which have marked effect upon the farmer's legitimate profits. Cleaniness, the dairyman's watchword, is in everything foremost. A separator which has not been thoroughly cleansed is certain to contaminate the cream, and as quality determines value in cream the importance of observation of cleanliness cannot be too forcibly expounded; furthermore a dirty separator does not, by a long way, recover the whole of the cream contained in the milk, therefore the net result which follows lack of scrupulous cleanliness is: (1) inferior quality cream; (2) cream is only partially recovered. For these reasons, apart from sanitary consideration, the reprehensible practice of leaving the separator unwashed overnight and running the milk through on the following morning cannot be too strongly condemned.

Temperature is another matter for consideration. Milk freshly drawn from the cow contains sufficient animal heat to insure satisfactory results, but loss of butter fat is inevitable when milk is put through cold. It is a very good plan to run a gallon or so of clean water, heated to about 150 degrees, through the separator immediately before commencing operations, which should be as soon as possible after the milk is drawn from the cow. The vat should be kept continuously well filled, turn on the tap, allow but a small flow at first, increasing gradually. If tap is turned full on immediately sufficient speed has been generated the bottom of the cream can will become filled with very thin cream, together with a quantity of milk solids. The presence of excessive quantities of milk solids, especially the proteids, cause rapid deterioration in quality. Speed and its uniform maintainance is a very important factor The separator should be turned the full indicated speed, and pace kept up evenly throughout. High-testing cream has an advantage over that of a low test, inasmuch as most of the milk proteids have been excluded, but as loss may occur by cream escaping in the skim milk if too hig a test is attempted, judgment and caution must be exercised. A test of about 42 per cent. will be found in every way satisfactory. A cooler is inexpensive and practically everlasting, and in the production of highest-quality cream an indispensible utensil, for by its use, undesirable odors absorbed by the milk after being drawn from the cow, and fodder taints, such as from feeding lucerne or rape in its green state to a very considerable state are eliminated. Cream subjected to the cooling process will keep in a wholesome condition for a much longer period than the untreated article, therefore the danger of sending over-ripe cream to the factory is diminished. Tinned utensils may, after considerable service, require re-tinning, and this is a matter that should never be neglected; the local tinsmith can do the job. When milk or cream comes into contact with the rusted surface of any utensil it quickly acquires a very disagreeable metallic flavour, and, further, it is an impossibility to keep in a state of thorough cleanliness utensils worn in the manner described. The Babcock tester, which should be in evidence on every farm, in addition to its usefulness in detecting the unprofitable members of the herd should be frequently used to check the cream test received from the factory, and results compared. The skim milk should be also frequently tested in order that leakage of cream in this way may be detected. For washing up utensils and separator there should be on hand an ample supply of clean boiling water. First rinse in tepid water, using a brush, *not a cloth*, then rinse in boiling water, again using the brush unsparingly, then steam wherever possible, and place out in the air and sunlight to dry. A little washing soda may be added to the boiling water, but any gritty soaps should never be used as they quickly wear off the tinned coating. Never wipe utensils dry, it is unnecessary, let the air and sunlight act. Cloths become, no matter what precautions are taken, a host for contaminating bacteria, which are transferred to the article it is used upon. Freshly-separated cream should be allowed to become cold before mixing it with that separated previously, and should be given a stir three or four times a day. In hot weather, as cream ripens rapidly; it should be delivered at the factory at least every second day. Cream can be kept much cooler if the can is stood in a tub of cold water. In transit to the factory the can should be protected from the heat of the sun by covering with a clean, wet sack.

SIXTH VICTORIAN EGG-LAYING COMPETITION, 1916-1917.

Commenced 15th April, 1916; concluding 14th April, 1917

CONDUCTED AT THE BURNLEY SCHOOL OF HORTICULTURE BY THE DEPARTMENT OF AGRICULTURE, VICTORIA.

Six Birds. Pen No.	Owner.	Breeds.	15.4.16 to 14.11.16	15.11.16 to 14.1.17	Total to Date (Nine months).	Position in Competition.
		LIGHT BREEDS.				
		WET MASH.				
1	G. McDonnell	White Leghorns ..	916	275	1,191	1
13	H. J. Meaddows ..	" ..	900	252	1,182	2
36	E. W. Hippe	" ..	882	286	1,168	3
3	W. M. Bayles	" ..	845	310	1,155	4
41	Excelsior Poultry Farm ..	" ..	860	277	1,137	5
37	J. M. Smith	" ..	858	275	1,133	6
10	J. H. Duncan	" ..	910	222	1,132	7
22	Mrs. H. Stevenson ..	" ..	853	266	1,119	8
28	S. Cheatle	R.C.B. Leghorns ..	838	280	1,118	9
40	A. Brundrett	White Leghorns ..	863	250	1,113	10
44	J. Jamieson	" ..	828	280	1,108	11
7	C. J. Jackson	" ..	867	236	1,103	12
38	V. Little	" ..	848	250	1,098	13
15	G. Laughlan	" ..	828	256	1,084	14
17	W. G. Swift	" ..	823	243	1,066	15
25	A. H. Mould	" ..	856	207	1,063	16
32	N. Burston	" ..	792	270	1,062	17
29	A. S. Hyndman ..	" ..	770	281	1,051	18
8	E. A. Lawson	" ..	763	286	1,049	19
39	L. McLean	" ..	783	256	1,039	20
43	S. Buscumb	" ..	757	272	1,029	21
11	R. W. Pope	" ..	767	260	1,027	22
14	W. R. Hustler	" ..	789	238	1,027	22
18	C. Ludwig	" ..	767	260	1,027	22
45	C. H. Oliver	" (5 birds)	792	230	1,022	25
27	John Blacker	" ..	803	215	1,018	26
23	T. A. Pettigrove ..	" ..	791	224	1,015	27
12	G. Hayman	" (5 birds)	769	244	1,013	28
16	F. Collings	" ..	751	261	1,012	29
34	F. G. Silberelsen ..	" ..	759	242	1,001	30
24	Mrs. H. N. H. Mirams ..	" (5 birds)	780	217	997	31
6	J. J. West	" ..	751	246	997	31
30	F. T. Denner	" ..	752	219	971	33
101	A. E. Silberelsen ..	" (5 birds)	719	241	960	34
19	Benwerren Egg Farm ..	" ..	700	252	952	35
26	Mrs. A. Dumas	" (4 birds)	738	196	934	36
5	W. G. Osburne	" ..	666	260	926	37
35	Tom Fisher	" ..	645	255	900	38
20	H. I. Merrick	" ..	622	257	879	39
4	Fulham Park	" ..	588	270	858	40
9	W. H. Clingin	" ..	611	246	857	41
32	E. F. Evans	" ..	615	236	851	42
31	J. H. Gill	" ..	559	273	832	43
		Total ..	33,374	10,902	44,276	
		HEAVY BREEDS.				
		DRY MASH.				
98	Marville Poultry Farm ..	Black Orpingtons ..	916	198	1,114	1
100	Oaklands Poultry Farm ..	" ..	860	246	1,106	2
97	D. Fisher	" ..	866	202	1,068	3
94	Mrs. H. Cead	" ..	726	190	916	4
96	H. Hunt*	" ..	678	220	898	5
95	Mrs. T. W. Pearce ..	" ..	720	161	881	6
99	J. Ogden	" ..	500	171	671	7
		Total ..	5,266	1,388	6,654	

SIXTH VICTORIAN EGG-LAYING COMPETITION, 1916–1917—*continued.*

Six Birds. Pen No.	Owner.	Breeds.	15.4.16 to 14.11.16	15.11.16 to 14.1.17	Total to Date (Nine months).	Position in Competition.
	LIGHT BREEDS.					
	DRY MASH.					
52	W. J. Thom	White Leghorns	979	307	1,286	1
46	W. H. Robbins	,,	987	246	1,233	2
53	W. N. O'Mullane	,,	929	287	1,216	3
59	T. A. Pettigrove	,,	934	222	1,156	} 4
54	Mrs. A. O. Hughes	,,	869	287	1,156	}
70	G. Wilkinson	,,	886	253	1,139	6
47	H. McKenzie and Son	,,	866	251	1,117	7
55	Rev. J. Mayo	,,	809	279	1,088	8
63	N. Burston	,,	769	315	1,084	9
69	E. A. Lawson	,,	809	269	1,078	10
65	Izard and Tierney	,,	848	221	1,069	11
67	Elizabeth Poultry Farm	,,	771	273	1,044	12
56	Mrs. Nicoll	,,	847	189	1,036	13
60	A. Greenhalgh	,,	773	261	1,034	14
58	C. Ludwig	,,	854	178	1,032	15
62	J. W. Morrow	,,	817	201	1,018	16
48	Thirkell and Smith	,,	777	227	1,004	17
61	C. C. Dunn	,,	801	196	997	18
66	Benwerren Egg Farm	,,	712	255	967	19
50	Clevedon Poultry Farm	,,	693	241	934	20
51	Reliable Poultry Farm	,,	691	233	924	21
64	A. Bennett	,,	639	247	886	22
49	C. Lane	,,	692	193	885	23
68	W. G. Osburne	,,	583	241	824	24
		Total	19,335	5,872	25,207	
	HEAVY BREEDS.					
	WET MASH.					
74	Oaklands Poultry Farm	Black Orpingtons	981	208	1,189	1
86	C. Ludwig	,,	847	235	1,082	2
87	S. Buscumb	,,	863	190	1,053	3
90	Excelsior Poultry Farm	,,	815	235	1,050	4
80	Mrs. T. W. Pearce	,,	827	216	1,043	5
89	Brooklyn Poultry Farm	,,	866	152	1,018	6
85	Mrs. M. Coad	,,	838	166	1,004	7
91	N. Papayanni.	,,	774	223	997	8
83	L. McLean	,, (5 birds)	786	209	995	9
92	J. H. Wright	,,	848	146	994	10
93	L. W. Parker	,,	763	204	967	11
88	A. D. McLean	,, (5 birds)	798	145	913	12
77	Mrs. G. R. Baid	White Plymouth Rocks (5 birds)	712	196	908	13
81	K. Courtenay	Faverolles	702	204	906	14
84	H. S. Trevana	Rhode Island Reds	663	217	880	15
72	Marville Poultry Farm	Black Orpingtons (5 birds)	741	136	877	16
78	Reliable Poultry Farm	,, (4 birds)	724	151	875	17
71	C. E. Graham	,,	663	208	871	18
82	J. Ogden	,,	581	206	787	19
76	L. A. Errey	Silver Wyandottes	609	170	779	20
75	Mrs. Drake	Rhode Island Reds	546	201	741	21
73	E. W. Hippe	,,	581	87	668	22
		Total	16,522	4,105	20,627	

REPORT.

The weather conditions during the past month have been fairly dry and cool, although one or two brief spells of warm days were experienced. The health of the birds continues good, but a number of birds are moulting earlier than usual.

The chief feature of the month has been visitors from all parts, including New South Wales, New Zealand, Queensland, South Australia, and United States, America.

Rain 46 points; temperature in houses, lowest 54 degrees Fahr., highest 103 degrees Fahr.

A. HART,
Chief Poultry Expert.

20/1/17.

VICTORIAN RAINFALL.

Fourth Quarter, Year 1916.

District.	—	October.	November.	December.	Quarter.
		Points.	Points.	Points.	Points.
Mallee North	District Mean.. ..	131	268	83	452
	Normal	116	71	86	273
	Per cent. above normal	13	277	..	77
	„ below „	..	..	3	..
Mallee South	District Mean.. ..	157	227	137	521
	Normal	107	85	92	284
	Per cent. above normal	47	167	49	83
	„ below „	..	..	..	..
North Wimmera ..	District Mean.. ..	175	226	215	616
	Normal	147	104	97	348
	Per cent. above normal	19	117	122	77
	„ below „	..	..	..	..
South Wimmera ..	District Mean.. ..	247	283	236	766
	Normal	182	128	116	426
	Per cent. above normal	36	121	103	80
	„ below „	..	..	..	..
Lower Northern Country	District Mean.. ..	265	205	202	672
	Normal	134	113	108	355
	Per cent. above normal	88	81	87	89
	„ below „	..	..	..	..

Victorian Rainfall—*continued.*

District.	—	October.	November.	December.	Quarter.
		Points.	Points.	Points.	Points.
Upper Northern Country	District Mean.. ..	319	229	251	799
	Normal	174	136	128	438
	Per cent. above normal	83	68	96	82
	„ below „	..	..	..	..
Lower North-East ..	District Mean.. ..	428	481	213	1,122
	Normal	246	187	190	623
	Per cent. above normal	74	157	12	80
	„ below „	..	..	..	..
Upper North-East ..	District Mean.. ..	602	641	371	1,614
	Normal	374	296	277	947
	Per cent. above normal	61	117	34	70
	„ below „	..	..	..	..
East Gippsland ..	District Mean.. ..	150	536	200	886
	Normal	296	220	260	776
	Per cent. above normal	..	144	..	14
	„ below „	49	..	23	..
West Gippsland ..	District Mean.. ..	352	432	287	1,071
	Normal	326	265	277	868
	Per cent. above normal	8	63	4	23
	„ below „	..	..	..	..
East Central	District Mean.. ..	428	576	472	1,476
	Normal	314	261	274	849
	Per cent. above normal	36	121	72	74
	„ below „	..	..	..	..
West Central	District Mean.. ..	351	330	286	967
	Normal	209	179	164	552
	Per cent. above normal	68	84	74	75
	„ below „	..	..	..	..
North Central ..	District Mean.. ..	427	315	336	1,078
	Normal	223	192	177	592
	Per cent. above normal	91	64	90	82
	„ below „	..	..	..	..
Volcanic Plains ..	District Mean ..	323	359	338	1,020
	Normal	216	176	155	547
	Per cent. above normal	50	104	118	86
	„ below „	..	..	..	..
West Coast	District Mean.. ..	294	435	259	988
	Normal	259	195	181	635
	Per cent. above normal	14	123	43	56
	„ below „	..	..	..	..

N.B.—100 points = 1 inch.

Following on the abnormal rains of September another wet month occurred in October, the rains being above average, except in Gippsland, the greatest deficiency being in the eastern part. The disturbances were mostly of monsoonal origin, but a great portion of the rain fell towards the end of the month, being the result of a great cyclonic visitation which caused nearly all the northern streams to flood. A greater number of frosts than is usually the case occurred during the month, but these did more good than harm, especially through their purification of the wheat crops, which promise almost throughout the State to be equal to record yields, except in the northern water-logged country, where floods did a great deal of damage. Potatoes and others crops were later than usually planted, owing to the wet conditions which prevailed. Shearing was also commenced later than usual, owing to the same cause, but the anticipated clip was generally deemed to be up to average weight. A vigorous growth in pastures was the general experience, and stock were in splendid condition. November rains were heavy throughout, and in many places established records, and on almost every day during the month rain was recorded. The day temperatures were thus reduced, and resulted in an extremely cool month. In fact, the highest daily maxima was below the nineties, a very uncommon experience for Victoria in November. Dairying was in a thoroughly flourishing condition owing to the great, and in parts almost excessive, growth of grass. The Murray and Avoca rivers were still in flood, and reached their highest points during the period. Hay cutting was almost finished in the Mallee, where crop prospects were excellent and the wheat generally clear of disease. In the north-east wheat prospects were decidedly promising, and oats exceedingly good. In many parts early sowings of potatoes were a failure, and the later settings hindered and delayed through the abnormally wet season. Abundant rains were again the case early in December, owing mainly to tropical visitations. During the latter half the weather cleared and rain was seldom noted, the anxiety to agriculturists being relieved as the rain ceased when harvesting operations should be in full swing. In the Mallee and Wimmera record yields were generally obtained, except in areas where floodings took place, such as in the Avoca watershed. Good crops were also harvested in the north-east and northern country, and satisfactory yields in the north central. Wheat and hay results were above average in the western district generally, though caterpillars and excessive moisture tended to militate against the anticipated results. Grass was everywhere abundant, and dairying prosperous. In Gippsland, hay crops were heavy, but in parts spoilt by wet conditions, and consequent lateness in harvesting. All classes of stock were in excellent condition owing mainly to the great super-abundance of grass. The Rutherglen fly was troublesome, and, in gardens, caused some havoc, and caterpillars, in the west and central parts, greatly damaged and lessened the market value of the crops.

H. A. Hunt.
Commonwealth Meteorologist.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

Young Trees.

Young trees of the Citrus family should now be making a good, thrifty growth. The foliage should be glossy, and the general appearance should be a bright green and healthy one. Occasional light waterings, as well as mulching of grass, or of well-rotted manure, will be helpful to the trees.

Young deciduous fruit trees will also benefit by having a grass or manure mulch; and, if it has not previously been done, unnecessary growths in the centre of the tree and on the main leaders should be removed.

Fumigation.

Evergreen trees, including those of the citrus family, that are infested with scale, should now be sprayed or fumigated to rid the trees of this pest. For spraying, a weak red oil emulsion, lime and sulphur spray, or resin wash will be found useful for the purpose. The most successful method, however, of dealing with the scale pest is by fumigation. The trees should be closely enveloped in an airtight sheet or tent, and hydrocyanic gas should be generated inside. The chemicals for generating the gas, as well as the fumes of the gas itself, are excessively dangerous, and great care should be exercised in their manipulation. A wooden, enamel, or earthenware vessel is placed inside the tent, the vessel containing a mixture of 4 fluid ounces of sulphuric acid, and 12 fluid ounces of water, the acid being placed in the vessel first. Four ounces of cyanide of potassium should then be quickly dropped into the vessel, and the tent closed down at once; the bottom of the tent all round should be covered with soil to prevent any of the gas escaping. The operator must take care that not the slightest portion of the fumes is breathed. Fumigation should be carried out at night-time or on a cloudy day, and the foliage of the trees must be thoroughly dry.

The Vegetable Garden.

Celery crops will now be a prominent feature in the vegetable section. The seed may be sown from January to March, and succession plantings should be carried out occasionally during those months. The growth of celery should be quick; a fair supply of water and a good rich, loose soil are helpful to its growth.

Ample water will now be required in the vegetable garden. The surface should be kept well hoed, and mulchings of manure should be given wherever possible.

Cabbage, carrot, turnip, radish, lettuce, peas, cauliflower, &c., seeds may now all be sown, and young plants from any seed beds may be planted out.

The Flower Garden.

Constant watering and hoeing will now be required to keep the flower garden in a condition of success. Cannas will require manuring; the old flowering stems should be removed to make way for the new growths. Dahlias and chrysanthemums will need a great deal of attention, staking the growths as they develop, disbudding, thinning out weak shoots, and removing unnecessary growths. The dahlias should receive a good soaking of water during the hot weather, and liquid manure or quick acting fertilizers should be given when the flower buds are developing. When chrysanthemum buds are very small liquid manure should be applied. Roses may now be summer pruned; all weak growths should be removed, and the strong ones shortened to a fairly good bud. The plants should then receive occasional waterings with liquid manure, and be kept well supplied with water.

All flowering trees and shrubs that have finished blooming should be pruned, the flowering growths removed, and, unless the seed is required, all seeds heads should be cut off.

Cuttings of pelargoniums, zonale and regal, may now be planted; delphinium spikes that have finished flowering should be cut down to make way for new growth, the plant being watered and manured. Seeds of perennial and hardy annual plants, especially winter-flowering sweet peas, Iceland poppies, stocks, and pansies, may now be sown, and a few bulbs for early flowering may be planted. The beds should be well manured and deeply worked in anticipation of planting the main crop of bulbs.

REMINDERS FOR MARCH.

LIVE STOCK.

Horses.—Feed as advised last month. Those in poor condition should be "fed up" in anticipation of winter.

Cattle.—Cows in milk should have plenty of succulent fodder and water easy of access. Algerian oats should be sown on suitable land for grazing off in the winter. Sow a mixture of oats, rye, and tares or peas for winter fodder or to fill silos. Only exceptional cows and those required for town milk supply should be served between now and July. Within the next two or three months is the best time for cows to calve, as they will pay to feed through the winter and give the best returns for the season, and be dried off when the grass is dry and scarce. Calves should be given lucerne hay or crushed oats where grass is not available.

Pigs.—Sows about to farrow should be provided with short bedding in well-ventilated sties. See that the pigs have shade, and water to wallow in. There should be plenty of cheap feed now, and pigs should be highly profitable. Read articles on breeding, feeding, &c., of pigs in *Journals* for April, 1912, June, 1913, May, 1915.

SHEEP.—All ewes should be kept strong for lambing. Crutch round tails and lessen accumulation of discharge, and consequent attraction to the fly pest at lambing time. Clear wool from round udders and teats and thereby save many a lamb in bad weather; especially is this necessary in the case of young ewes of the Merino and Lincoln crosses. Clear wool from eyes also. In crutching ewes when close to lambing lay them over carefully, grasp by the thigh low down, not by the flank as is generally done, which is a careless practice. Pure British breeds of ewes and very coarse cross-breds may still be only coming in season; rams should be left mated to make sure. Have good grass paddocks, if season favorable, to cut off ewes with early-born lambs into, for extraordinary prices will be available again this winter.

POULTRY.—Cull out the drones and get rid of surplus cockerels. Keep forward pullets well fed—eggs are rising in value. Repairs to houses should be done this month. Thoroughly cleanse all houses and pens. Spray ground and houses with a 5 per cent. solution of crude carbolic acid, to which should be added a little lime—this will act as a safeguard against chicken pox; burn all refuse and old feathers. Provide a liberal supply of green food. For each moulting hen, add a teaspoonful of linseed to the morning mash. Use tonic in water, which should be kept in cool shady spot.

CULTIVATION.

FARM.—Work fallow where possible for autumn sowing of cereals. Sow winter fodder crops, such as rye, barley, and vetches. Prepare land for lucerne plots for autumn seeding. Make silage of maize and other crops for winter use.

ORCHARD.—Prepare new land for planting; plough deeply and subsoil; leave surface rough. Plant out strawberries after first rain. Plant crops for green manure. Continue to fight the Codlin Moth.

VEGETABLE GARDEN.—Prepare ground for winter crops. Plant out seedlings in moist soil. Sow cabbage, cauliflower, lettuce, early peas, swede turnip, beet, carrot, radish, and early onions.

FLOWER GARDEN.—Cultivate and water. Feed dahlias, chrysanthemums, and roses. Plant out shrubs, trees, and all kinds of bulbs. Sow hardy annuals. Plant geranium and pelargonium cuttings. Spray for Aphis, Red Spider, and Mildew.

VINEYARD.—Select scions, if not done last month. Where ripening is difficult, assist by removing basal leaves only, as soon as berries change colour. This is the month for drying currants, sultanas, and gordos (Lexias and Clusters). Do not pick before grapes are properly ripe. For instructions for packing grapes for export, apply to Department. Shipments should be made in March and early April.

Cellars.—Vintage month. For light dry wines, pick as soon as grapes are ripe; do not wait for over-maturity, as is so often done. Pay attention to acidity; correct same if necessary with tartaric acid or late grapes. Acidimeter supplied by Department; price, 3s. 6d. Sulphiting and the use of pure yeasts are strongly recommended, as they insure production of sound wine; further information supplied on application.

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TEACHERS' FARM SCHOOL.

SECOND SESSION.

Held at the State Research Farm, Werribee, January 22-27, 1917.

In September, 1915, some seventy teachers, from schools in which agriculture forms part of the curriculum, were accommodated for a week at the State Research Farm, Werribee. They attended lectures and demonstrations arranged by the staff of the Department of Agriculture, and thus inaugurated a new departure at the Research Farm—that of direct teaching. So successful was this, the initial school, that it was decided to conduct a similar course of instruction each year, and the second took place on 22nd-27th January last.

On the first occasion the classes were held at Show time, and that date was again fixed for them, but the unprecedented rains caused a postponement until January. This, of course, limited the scope of the field demonstrations, but sufficient harvest work was going on to illustrate the lectures and to bring the students into close touch with practical agriculture.

The aim of the school is to give teachers of agriculture a better insight into their subject, and although a week is all too short, yet it is certain that the classes are doing good work, and, further, from the experience gained an even more efficient course will be designed as time goes on.

That the training has been appreciated is shown by the fact that more teachers applied this year than could be accommodated. A selection had, therefore, to be made, with the result that all quarters of the State were represented, and thus the knowledge gained will be widely disseminated.

At the Research Farm, where there is an irrigation scheme, not only experimental work of a standard character is proceeding, but also three of our staple industries—wheat-growing, sheep-raising, and dairying—

are carried on. Teachers from all districts, therefore, found something to interest them specially.

The students, to a man, made the most of their opportunities, and, armed with note-books, made copious notes at the lectures and at the practical demonstrations. It was the custom for the lecturers to invite discussion at the close of each class, and many a knotty problem was consequently unravelled.

The lectures embraced both agriculture and animal husbandry, and were supplemented by practical demonstrations in the field; the plan followed being to alternate the lectures with the practical demonstrations, and much of the work was illustrated with the lantern.

The laboratory was thrown open to the teachers, and several microscopes were available for the study of the minute structure of plants, animals, and bacteria. Considerable interest was also evinced in the set of agricultural text-books provided.

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Mr. Barr speaking on Germ Life.

Under the agricultural section the following subjects were dealt with:—

Soil problems and cultivation methods, wheat and its cultivation, forage crops, lucerne culture, irrigation methods, cereal breeding, potato culture, tree culture, insect pests.

And under animal husbandry—

Dairying illustrated, germ life in the dairy, dairying, physiology of digestion, foods and feeding, contagious diseases of stock, first-aid treatment of stock, herd testing, demonstrations on farm animals—cattle, sheep, horses.

Mr. A. E. V. Richardson, M.A., B.Sc., the Agricultural Superintendent, had charge of the school and its organization, while Mr. R. H. Greenwood, M.Sc., Organizing Inspector of Agriculture in State Schools, assisted on behalf of the Education Department.

The arrangements for accommodating the teachers were simple, yet effective—one of the large grain sheds being converted into four dormitories, with improvised lavatory and shower-baths adjacent. The catering left little to be desired, and that the teachers bore the cost of this themselves is ample evidence of their earnestness to profit by the course of instruction.

SYNOPSIS OF THE LECTURES.

Agriculture.

1. Soil Problems and Cultivation Methods.

The lectures on this subject embraced the more important facts concerning the physics, chemistry, and biology of the soil and their practical application. Such things as pore space, water-holding capacity, conservation of soil moisture, plant food and its absorption and elaboration by the plant, analyses of soils and their signficance, and the factors affecting soil fertility.

The above were all referred to Victorian conditions and the exact purposes of our cropping practices, such as bare fallowing, green manuring, crop rotation, top dressing pastures and the application of fertilizers and amendments were explained.

2. Wheat and its Cultivation.

The lecturer dealt with such problems as the world's wheat industry, its future, the relation of production in Australia to the world's output, marketing of wheat, prices, the wheat belt of Australia, methods of cultivation, preparation of the seed bed, varieties to sow, seeding, manuring, pickling, haymaking, harvesting, cost of production, and the essential factors for success in wheat growing.

3. Forage Crops.

The range of forages available to farmers, fodders for milking and fattening; maize, millets, sorghums, cereals, legumes, and roots were also discussed; the rotation and succession of forages, methods of cultivation, residual effects on soils, and the conservation of forages.

4. Irrigation Methods.

The lecturer outlined the irrigation practices of India, Egypt, United States, and the East, and the chief irrigation systems of the world. With the aid of the lantern, the extent of irrigated agriculture and its relationship to general agriculture were illustrated. Turning to Australia, the water resources of the State, the irrigation settlements, and the special conditions appertaining to them were discussed. The relation of soil to water, the duty of water, preparation of land for irrigation, grading methods, drainage, with special reference to Mildura, Renmark, Rochester, Bacchus Marsh, and Werribee, as well as Yanco, in New South Wales, received attention.

5. Cereal Breeding.

A particularly fine lecture, in which the principles underlying the breeding and selection of cereals were dealt with. The following were discussed, and a demonstration on cross-breeding was given:—Difference between animal and plant breeding, continuous and discontinuous

variation, origin and species, evolution, laws of inheritance, selection, cross-breeding, and the inheritance of unit characters, this latter being illustrated by actual crossbred wheats and barleys grown and segregated on the farm.

6. POTATO CULTURE.

Statistics of potato culture, soil and climatic conditions for potatoes, preparation of the soil and seed harvesting, and factors for success in potato growing.

7. TREE CULTURE.

This formed a particularly interesting lecture for the teachers. The lecturer dealt with the culture of trees for shelter, shade, and ornament, and the suitability of trees for special localities. The best methods of propagation, planting, and pruning also received attention.

8. INSECT PESTS.

Of fruit trees, vegetables, crops, stored grain; the methods of dissemination and control.

Animal Husbandry.

1. DAIRYING ILLUSTRATED.

Breeds; milking points and type; escutcheon theory; care of bull, cow, and calf, shelter and protection: rugging; lactation period and condition influencing it; followed by demonstration in the cow byres, showing such points as preparation of udder, stripping, construction of yards, sheds, weighing and recording milk yield.

2. GERM LIFE IN THE DAIRY.

Microbes, their nature and distribution, life history, food supply, conditions suitable for their growth, effect of sunlight and temperature, beneficial and harmful bacteria.

3. DAIRYING.

Care and handling of milk, cleanliness in yard and byres, excitement, internal and external influences affecting secretion of milk, hours of milking, source of contamination, cooling, aerating, pasteurizing, sterilization, followed by demonstration in the dairy and on germ life, illustrated with cultures, &c.

4. PHYSIOLOGY OF DIGESTION.

Secretion of milk; metabolism.

5. FOODS AND FEEDING.

Composition of foods, digestibility, animal requirements, available energy in food, loss of heat, maintenance. internal work; feeding for milk production, variation of food according to yield.

6. FOODS AND FEEDING.

Fattening; valuation of feeding stuffs; comparative and unit values; classification, succulent, dry, and concentrated, compounding ration

7. CONTAGIOUS DISEASES OF STOCK.

Diseases communicable by milk; milk and infant mortality; the fight against tuberculosis.

8. FIRST-AID TREATMENT OF STOCK.

The animal a living body, subject to influences as in man; simple wounds and common ailments and their immediate treatment.

9. HERD TESTING.

Objects, benefits, errors; results of Government herd testing in Victoria; how to conduct the Babcock test. Demonstration—sampling, testing, computing acidity.

Practical Demonstrations.

A great feature was made of the practical demonstrations, and the farm, with its many-sided activities, is admirably adapted for that purpose.

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Mr. Wilson (Farm Manager) explaining the points of a sheep.

The lay-out of the farm, with its systematic method of subdivision, fencing, young shelter belts, and the design of the farm buildings, were the subject of much interest, and many notes and rough sketches were made by the teachers. These notes should prove very useful to them as object lessons for the children, or, indeed, to the farmers of the country districts, for the school teacher is often referred to as final arbiter in discussions ranging from the making up of income-tax returns to, say, the laying out of a farm.

The whole of the farm buildings have been planned only after careful consideration, and the structures were designed each of them to teach a lesson. They embody the mature results of observations and experience in the best farming practice. These buildings are set out on the H system

—the dairy and milking shed and stable stand close at right angles to one end of the fodder building, but on opposite sides of it. Silage, chaff, and concentrates are all stored close together at this end of the fodder building, and there is a mixing floor between the bins from which the feed is conveyed by trolley to the cow shed and stable, so that a minimum of labour for feeding up is required. The fodder building forms the crossbar of the H, at the other end of which the implement shed and grain shed are placed in a similar position to the dairy and stables. The whole forms a very compact, handy set of buildings, which in general design and principles are suitable for copying, either wholly or in part, in similar dimensions or reduced as

(Reproduced by kind permission of *The Weekly Times*.)

Mr. Richardson, Agricultural Superintendent, speaking on the Rainfall of Victoria.

required, according to the size of the farm and the kind of farming practised.

The construction of the dairy and cow byres with the several designs of stalls and floors erected for demonstration purposes; the rations fed to the cows, the treatment of the dairy herd; the handling of the milk and the systematic testing and weeding out of the cows, all these received close attention, and no doubt many valuable impressions were carried away.

Turning to the stock, the Red Poll herd of dairy cows, the brood mares and stallion, "Major Oates," and stud sheep were the subject of practical talks; for instance, the points in judging and the method

of examining a horse for soundness, as also the characteristics of the several breeds of sheep on the farm were demonstrated, the noteworthy stud of high class Suffolk sheep being of particular interest in view of the ever ascending mutton requirements of the Empire.

In the irrigation area the visitors were treated to a fine sight and walked through acres and acres of lucerne in all stages of growth.

A six weeks' lucerne crop, intended for seed.

(Reproduced by kind permission of *The Weekly Times*.)

Mr. W. A. N. Robertson (Chief Veterinary Officer) Lecturing

Certain of the paddocks had been sown as recently as last spring, others were several years old and showed a magnificent stand of lucerne, while portion of the area was being devoted to seed production. Watering was in progress, and the best methods of applying it were pointed out, as well as the effects of injudicious watering. Practical hints for determining where too much or too little water has been applied, the time to cut for hay, methods for harvesting and stacking the hay, were given.

A visit was also paid to the experimental lucerne area where the effects of various manures, rate of seeding and spacing of rows for seed, inoculation and liming tests, and results obtained, were explained.

The experimental wheat plots were visited, and although these had been harvested, certau cultural operations and the feeding off with sheep were in progress. As all the plots are systematically laid out alongside and at right angles to the roadways, and are clearly labelled, visitors came away with a very clear impression of the nature and objective of the experiments; the stud plots in particular, with hundreds of new cross-breds in all stages of being evolved, excited considerable comment.

A talk on the Horse.

OPENING OF THE SCHOOL AND MINISTERIAL VISIT.

On Monday morning, after a few words of welcome, Mr. Richardson, Agricultural Superintendent, briefly set forth the objects of the school and expounded the syllabus of the work. Without any further formality he began to speak of the subject of the first lecture, and soon pencils began to fly and leaves to flutter as the teachers jotted down rough notes.

On Thursday the Minister of Agriculture (The Hon. F. Hagelthorn), the Minister of Public Instruction (The Hon. H. S. Lawson), accompanied by the Director of Agriculture (Dr. Cameron), and the Under Treasurer (Mr. Minogue), paid a visit of inspection to the school. The party attended a lecture by Mr. Richardson on "Wheat, and its Cultivation," and stayed to lunch. At this function Dr. Cameron presided, and paid a tribute to the Honorable George Graham, who was Minister for Agriculture when the farm was established, and whose connexion with its establishment was to be marked by bestowing the name "Graham" on one of the new wheats bred at Werribee.

Mr. Cook, a teacher from the Goulburn Valley, proposed the toast of the Departments of Agriculture and Education, emphasizing the cordiality of the *entente* that has sprung up between the two Departments, and deprecated the criticism so frequently levelled against the prominent officers. Mr. Friday, principal of the Sale Agricultural High

School, in supporting the toast, expressed the satisfaction of the students with the course of Agriculture at the Farm School. He was sure the experience would react beneficially on the agriculture of the State. He enlarged on the teachers' responsibility and influence on the grown-up community per medium of the children. Mr. Hilton, a teacher hailing from South Australia, who came over at the instance of the South Australian Department of Education to report on the school, spoke enthusiastically of the instruction he had received. He commended to their notice the Agricultural Bureaus of South Australia.

Mr. Lawson, Minister of Education, was cheered as he rose to respond. After thanking the teachers for their expression of good-will he intimated his belief that teachers, especially men who are so enthusiastic as to give up a week of their holidays to the study of agriculture, were capable of doing a vast amount of good for the farming interest. Public appreciation of agricultural education must be awakened, but, unfortunately, the Government, faced with the stern need for economy, proposed to close one or two of the farms at High Schools. This might seem a retrograde step, but possibly appreciation might be aroused if they were being taken away. It was heartening to notice that over 700 primary schools were giving attention to agricultural subjects. He laid stress on the important work the teacher could do in taking the child early and giving his mind a bend towards rural pursuits. The cityward drift of population in Australia must be stemmed. It was the duty of the Government to make country life attractive and profitable, and they looked confidently for the teachers' co-operation. Teachers had opportunities greater than most other men to set the standard of social life. Rural residence could be made more pleasant by the multiplication of halls, schools, recreation reserves, parks, and public gardens. Teachers should induce the farmers to co-operate in social matters, and so raise the standard of their life as individuals. It was pleasing to see that many old prejudices were passing away, the present-day farmer was not so much inclined to look askance at such social ameliorations as the introduction of the gramophone, the piano, the easy chair, and a more generous cuisine. He was delighted, on a recent visit to the Wimmera, to see among the farmers such evidence of prosperity and comfort, as the telephone and the motor-car, and to see attention paid to the æsthetic appearance of the homesteads. A good teacher was a boon in a farming district, and became the philosopher and friend of the community. Concerning criticism of public men and public officers, all he asked was that it should be intelligent criticism, constructive, rather than carping. In closing, he paid a high tribute to the work the teachers were doing in the matter of war relief, and the fine spirit they were showing in the midst of temporary and unavoidable hardships, such as deferment of increments, and the like.

Mr. Hagelthorn, Minister for Agriculture, said that the Government was deeply indebted to its fine body of school teachers. The students he saw around him might reap no financial gain from the course they were pursuing, but the knowledge they were acquiring would undoubtedly be a gain to their districts. He had been greatly interested in the remarks of the teacher from South Australia, and thought that we, in Victoria, had a good deal to learn from the system of Agricultural Bureaus in vogue there. He had also listened with great pleasure to the lecture by Mr. Richardson, a man who had an

Inter-State reputation. The thought had struck him that if the lecturers' precepts were followed, and we increased our yield by several bushels per acre by seed selection, a few more by proper fallowing, a few more by scientific manuring, then Germany's 30 bushels per acre would ultimately be reached. The weakness of the farm school was that too much had to be crammed into the limited time. In future years there might be several similar schools held; one for dairying, one for wheat growing, one for irrigation, and so on. Touching on the apparent failure of the Agricultural High Schools, he pointed out that every progressive country had passed through a similar experience, and no doubt our failure was more apparent than real. For 40 years the Agricultural Schools of the United States had battled against adversity, but during the last twelve years had met with dazzling success, and it was confidently trusted that the same success would ultimately attend the efforts being made here.

THE SOCIAL SIDE.

The evenings were spent both pleasantly and profitably. On Monday evening Mr. Frank Tate, M.A., Director of Education, accompanied by Professor Laby, of the Melbourne University, and Dr. Cameron, Director of Agriculture, came down and gave the class a rare treat. Mr. Tate's address on Shakespeare's "As You Like It," given in his own inimitable way, was a revelation of scholarly interpretation, which both amazed and amused his audience. It was an hour and a half of unalloyed pleasure, such as is but seldom experienced, and was appreciated accordingly.

On Tuesday evening Mr. Gates, Inspector of Schools, gave an illustrated lecture on "Tour Planning," dealing largely with the social side of life, and his remarks were recognised as highly interesting and instructive.

Wednesday evening was occupied by Mr. W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer, in an illustrated lecture on "First Aid to Animals," which, although not intended as a social effort, was equally entertaining, if judged by the time the audience insisted on keeping Mr. Robertson at his "turn."

The teachers attending were throughout a happy family, and on Thursday evening they organized a social evening, on which occasion the local residents were invited. A capital concert was arranged, some excellent items being given, and a collection taken up in aid of the Red Cross realized a handsome sum.

On the last day of the class the Water Supply Commissioner generously sent two chars-a-banc to convey the students round the Werribee settlement, a very interesting trip resulting. The party was in the hands of Mr. Horsfield, of the Water Supply Department, and stops were made at points of interest, where the working of the Dethbridge water meter was explained, and the system of grading and irrigation observed.

This was the first time many of the teachers had been afforded an opportunity of coming into close touch with an irrigation settlement, and to them the prosperous condition of the Werribee Farm was most informative.

T.A.J.S.
H.A.M.

LIST OF LECTURERS AND DEMONSTRATORS AT TEACHERS' FARM SCHOOL.

Agricultural Department.

S. S. Cameron, D.V.Sc., M.R.C.V.S., Director of Agriculture.
A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.
W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer.
Temple A. J. Smith, Chief Field Officer.
C. C. Brittlebank, Vegetable Pathologist.
R. T. Archer, Chief Dairy Inspector.
H. C. Wilson, Manager, Central Research Farm.
E. E. Pescott, F.L.S., Pomologist.
C. French, Entomologist.
J. T. Ramsay, Potato Expert.
B. A. Barr, Dairy Supervisor.
G. S. Gordon, Field Officer, Werribee.
R. R. Kerr, Dairy Supervisor.
H. A. Mullett, B.Ag.Sc., Agricultural Science Cadet.

Education Department.

F. Tate, M.A., I.S.O., Director of Education.
W. F. Gates, M.A., Assistant Chief Inspector of Schools.
R. H. Greenwood, M.Sc., Organizing Inspector of Agriculture.

APPLE CULTURE IN VICTORIA.

By J. Farrell, Orchard Supervisor.

(Continued from page 35.)

Pruning the Yates.

Prior to the advent of cool storage, the Yates, like the Rokewood, Rome Beauty, and others with late ripening and good-keeping charac-

Plate 62.—Yates, twelve years old, unpruned.

teristics when stored in the ordinary way, was regarded as a serviceable and profitable variety, and it was largely cultivated for export, as well as for our own markets. Mainly owing to the general adoption of the cool storage principles, however, the Yates has not been so extensively planted during recent years as formerly. Other varieties more popularly favoured for dessert purposes, and which were more difficult to

preserve in ordinary storage, may now be kept in cool stores for a sufficiently long period to meet all domestic requirements.

The blooms of the Yates are highly self-fertile, and as they also exercise a beneficial influence upon those of other varieties partly lacking in this respect, and growing near it, notably the Jonathan, the Yates is frequently interplanted with varieties which show sterility to insure cross pollination.

Plate 63.—Same Tree as in Plate 62, pruned.

Its partial immunity from bitter pit also enhances the value of the Yates, and possibly when it is thoroughly tested as intermediate stocks of various lengths to act as a kind of filter for the sap of the varieties most subject to this disease it may prove somewhat efficacious.

The Yates thrives best and yields its heaviest crops of fruit when cultivated on rich, moist, but well-drained soils, and in the localities where fairly cool climatic conditions prevail. The large trees produced under these conditions rarely come into bearing early, except when the fruiting habit is developed by systematic pruning. When this object is

attained and normal seasons ensue heavy crops are harvested with customary regularity.

No matter how favorable the conditions surrounding the growth of the Yates may be it rarely produces fruit above the dessert size. In fact, it is often difficult to keep the fruit up to a reasonable size, even on vigorous growing trees. It has been stated previously that when the trees are growing over vigorously excessive leader duplication, and surplus lateral growths should be encouraged until the trees have settled down to normal conditions when the surplus growths may be removed with a view to keeping the fruit up to standard size.

Plate 62 shows a twelve-year-old Yates coming in to full profit. This tree is on rich soil, and hitherto made strong growths. Surplus sub-leaders were retained and they have been removed during the last two years. Those holding the uppermost positions were first thinned out, and the one marked (a) was the last to be removed. The leaders are heavily clothed with light laterals.

Plate 63 shows the same tree pruned. The point (a) indicates the position whence the sub-leader was removed. The writer's treatment of the sub-leader and laterals of this tree last year was considered drastic pruning, but the crop of fruit it produced subsequently was so heavy that the individual fruits were under 2 inches in diameter, and consequently practically unmarketable. This experience, in conjunction with many other examples of its kind, has convinced the writer of the absolute necessity of hard pruning the Yates, Pomme de Neige, Morgan's Seedling, and others with similar fruiting characteristics after they have commenced to bear. And this method of pruning treatment is through intuition occasionally practised on these varieties by fruit-growers. Poor, light soil, and particularly if it is undrained and liable to part freely with its moisture during warm weather, should not be selected as a home for the Yates, even with the expressed intention of cross-fertilizing sterile varieties. Commercial failure almost invariably attends the cultivation of the Yates under those adverse conditions as the trees produced are weak and the fruit is small.

When varieties, such as the Jonathan, the blooms of which are often sterile or partly sterile to their own pollen when grown on rich land, are cultivated on soil with a low standard of fertility, they often lose their sterility and become fruitful without the assistance of cross fertilizers. However, when it is the fruit-grower's intention to plant Jonathan, for instance, on poor soil, and he decides to interplant with a suitable variety to secure cross pollination, one more thrifty and profitable under these conditions than the Yates should be chosen. As the Delicious and Sturmer bloom simultaneously with Jonathan, and consequently suit the purpose, one of these may be selected.

Plate 64, Fig. 1, is a three-year-old Yates leader removed from the four-year-old wood of a six-year-old tree. It was cut too long at (a) in the then yearling wood. If pruned at (i) instead in all probability light laterals would have been produced from the buds on the barren wood below (c) The (b) cut was well gauged as ideal fruit-wood has been produced on the two-year-old wood. When the cut (g) was made in the yearling growth this portion should have been completely suppressed by pruning at (e), and it is obvious that this is the point from which the growth should be now removed. The lateral opposite this one on the leader should be cut off at (d). The

correct cut for the two vertical growths near the point of the leader is to prune them at their base (*f*). The three light laterals on the three-year-old leader wood may be pruned as marked (*x*), and subsequently worked back as explained in connexion with similar growths on the Jonathan. Then when the leader is cut at (*h*)

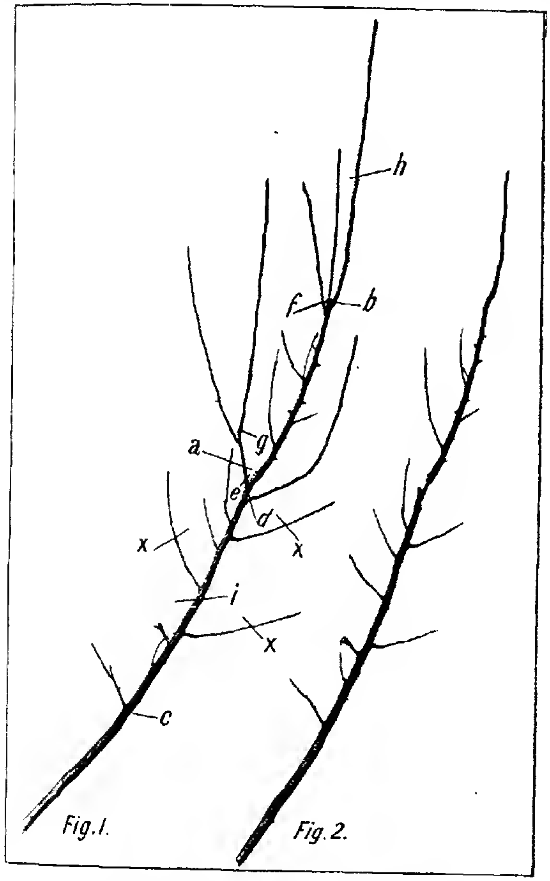

Plate 64.—Yates leader, pruned and unpruned.

it becomes a rather good type. Fig. 2 shows the same leader pruned, and it is a fairly good specimen, except for the barren wood near the base. But it will be understood how this barrenness may be prevented.

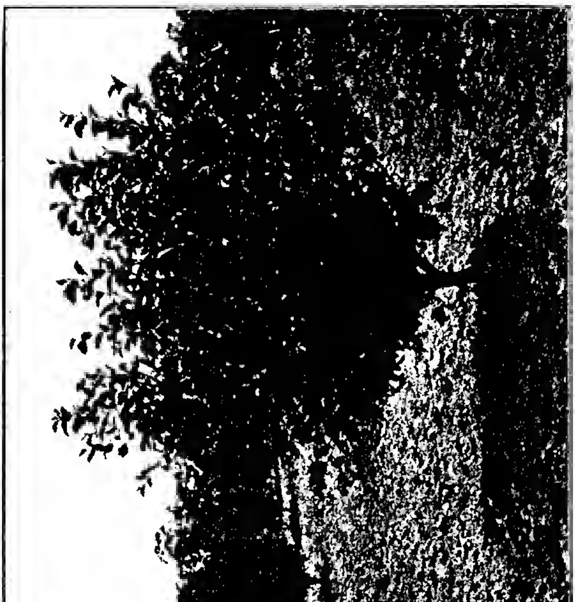

Plate 65.—A block of four-year-old Yates Trees.

Plate 65 shows a block of four-year-old Yates trees. The land on which they are growing is only moderately rich, but owing to perfect drainage, good cultivation, and the application of a little artificial manure, the trees are making strong growth. In fact, it would appear

Plate 66.—A row of ten-year-old Yates Trees.

as if the leaders are too densely crowded, but in four-year-old trees, and particularly on land with a rather low standard of fertility this is an advantage, rather than a defect, because, at next winter pruning there will be an ample supply of growths to select from in order to

complete the establishment of the leader systems of the trees. Should it be desired to prevent the continuance of rank growths, manuring may be suspended for a year or two until the trees begin to bear. Then their branch systems may be easily controlled by pruning, when the application of fertilizers may be resumed with advantage.

Plate 66 shows a row of ten-year-old Yates growing in a portion of the same orchard. Their treatment, while young, was in every particular similar to that which those in Plate 65 received, except that they were established on much higher stems than the four-year old trees.

The general adoption of short stems during recent years has been brought about as a result of experiments during the evolution of modern pruning science.

Plate 67.—Pomme de Neige, fourteen years old, unpruned.

These trees, although making fairly strong growth annually, are good, consistent bearers, and thoroughly amenable to annual winter pruning.

PRUNING THE POMME DE NEIGE.

The Pomme de Neige displays thriftiness, even on poor soil, and makes strong growth when cultivated in a district where the land is more suitable, and where the climatic conditions generally favour apple culture. Like the Yates, strong growing trees, even while young, do not produce fruit of a correspondingly large size, as it is invariably of a rather small dessert standard. But, unlike the Yates, when the Pomme de Neige trees are weak the fruit they yield does not become reduced in size in the same ratio as in the case of the Yates.

This variety usually responds so well to good cultural treatment that the trees growing under these conditions are mostly vigorous. When the surplus leaders, previously mentioned, have been thinned out after the trees have commenced to bear, those remaining usually produce a heavy fleece of lateral growths of various strengths annually. The longer and stronger of these should be shorn off at winter pruning, while the shorter and weaker ones may be retained, so that they may build up fruit buds on which they fruit during the succeeding year. But the tree produces the major portion of its crop on the more highly-developed fruit spurs except on the off year of a biennial cropping variety when most of the fruit is produced on the two-year-old laterals.

Plate 67 shows a fourteen-year-old Pomme de Neige tree photographed before it received its last winter pruning. The small laterals, fruit spurs, and knobs are not so noticeable as they are subsequent to the pruning operation being carried out.

Plate 68.—Same Tree as in Plate 67, pruned.

Plate 68 is the same tree pruned. A clearer view is here obtained of the class of light laterals, and spurs retained, and the general pruning treatment advocated in respect to this variety.

PRUNING THE IRISH PEACH.

The Irish peach has not been so extensively cultivated in Victoria during recent years as formerly. It is one of the old varieties which is gradually losing favour with apple growers, owing chiefly to the introduction of more popular, thrifty, and profitable sorts. It is figured here, not because its cultivation is advocated under existing conditions, but on account of the object lesson in pruning which it illustrates. Like the Rome Beauty a characteristic of this variety is to produce barren growths. But the Rome Beauty gives most of its barren leader wood while under five years of age, although, when older, barrenness sometimes occurs and particularly when long secondary

growths are made to assume the leadership, and not pruned hard back. Barrenness of the Rome Beauty laterals is usually confined to the period during which the trees are making strong growth, as it rarely occurs to any appreciable extent after they have settled down to fruit bearing under normal conditions. The tendency with the Irish peach, however, is to produce barren wood, both leader and lateral, during the whole life of the tree. From the time the tree is young, when pruning operations commence, it is essential that they should be continued annually and without intermission during the life of the tree, as if discontinued it soon becomes a willowy, weeping, tangled mass. If allowed to remain in this condition for a few years, and particularly if the soil is allowed to remain uncultivated, the wood, as well as the fruit produced on it, shows, like other varieties of similar characteristics

Plate 69.—Irish Peach, fourteen years old, unpruned.

in this respect, a disposition to degenerate. Whereas, if its pruning requirements receive regular attention annually, and with proper cultivation, the wood may be kept healthy, fruit of average size and quality produced, and a tree with fairly good symmetrical appearance maintained.

Generally speaking, this method of treatment keeps trees of delicate constitution invigorated. But, owing mostly to the varying soil and climatic conditions which are in the main responsible for the continually evolving variety characteristics, some of which render certain varieties predisposed to degeneration, the fruit-grower should be on his guard against the degenerate which, on being observed, may be grafted over if the stock is sound, if not replaced by a more thrifty variety.

Plate 69 shows a fourteen-year-old Irish peach tree before being pruned this year. This tree has been kept regularly pruned since it was planted, and consequently the branch system is open and the leaders are well spaced and developed. And in consequence of the operator's knowledge of the nature of the wood, which is somewhat similar to that of the Rome Beauty, the leaders aro clothed with laterals of as fruitful a character as it was possible to obtain under the circumstances.

Plate 70 is the same tree showing the method of pruning advocated in this case. It will be observed that the weak, pendulous laterals, some of the stronger ones with fruit knobs, and the fruit spurs were retained, while the stronger and more vertical growths were pruned away.

Plate 70.—Same Tree as in Figure 69, pruned.

PRUNING THE STATESMAN.

The Statesman, on account of the thriftiness which it displays in the various districts in which it is cultivated, the rather attractive appearance, uniform size, and good-keeping qualities of its fruit, is fast coming into prominence as a profitable dessert variety to cultivate for export as well as for home markets. It is a consistently prolific bearer, and up to the present cross pollination has not been found necessary. In fact its fertility in this respect, as far as can be judged, is of a high standard. But there is no guarantee that these conditions will continue, owing to the many other altering conditions which bring about evolutionary changes in the constitutional make-up of the apple tree.

And this may necessitate provision being made for cross pollination of this variety later on.

In consequence of its strong, upright habit of growth, orchardists often experience considerable difficulty in shaping the tree into the modern type. When the yearling whip-growth is planted out, and cut so as to produce the main arms on which the branch system of the tree is subsequently constructed, the three growths, made from the first cut, usually grow too upright. When treating these on the second

Plate 71.—Statesman, twelve years old.

occasion, instead of pruning to two side buds on each growth to duplicate the leaders, as in the case of varieties more amenable to modern pruning treatment than the Statesman, they should be cut short to inner buds. At next winter pruning the growths produced from the inner buds together with the two-year-old portions of wood, which forms the internodes between them and the secondary outside growths, should be removed. In consequence of the outer shoots occupying lower posi- ... two-year-old wood than those produced from the terminal

leads, their angle to the vertical is more open. When this method of treating the leaders is practised for a few years a tree with an open centre will result, as compared with the partly conical one obtained through pruning in the ordinary way.

Plate 71 is a Statesman tree twelve years old and a fairly good type. After this variety comes into bearing there is rarely any necessity to provide lateral growths as the fruit spurs develop naturally on the leaders, and they extend to such a degree as to obviate retention of laterals.

Pruning the Reinette de Canada.

The Reinette de Canada, although a strong grower while young, is one of those most easily shaped into the modern type. Its leaders multiply freely, and, as they naturally assume a nice angle to the vertical, this is regarded by experts as one of the most easily pruned varieties. The retention of laterals is rarely necessary, as ample fruit spurs are usually formed along the leaders.

Plate 72.—Reinette de Canada, sixteen years old.

Plate 72 shows a Reinette de Canada tree, the surplus leaders of which have been thinned out, and the remaining ones shortened back as occasion required and as explained in connexion with a tree of the same variety figured in Plate 40.

Pruning the Rymer.

The Rymer is another of the old varieties which is gradually going out of cultivation. The tree is hardy, a vigorous grower, and thrives well in most of the districts when cultivated in Victoria. It fruits freely when it has settled down to bear. The fruit is fairly uniform

in size, rather attractive in appearance, ripens late, and keeps well, but it lacks good quality—the most essential characteristic of the apple.

However, the object here is not to deal with the Rymer so much in relation to its commercial value as in regard to the principles of pruning involved in its case, on account of the rare fruiting habit of this variety. When given a reasonable amount of care and attention the trees usually make good growth, and are easily shaped into the modern type. But a careful study of the habit of growth, and method of fruiting more particularly, is essential in order that the pruner may

Plate 73.—Rymer, sixteen years old.

be enabled to obtain the best early results from the Rymer. While the trees are under nine years of age, and making strong growth, the fruit is mostly produced on the terminal buds of the yearling laterals, which, on the whole, are rather short, as compared with those produced by most of the other varieties. In pruning trees up to the age mentioned it is obvious that the points of the laterals should not be removed except for the purpose of securing a succession of such growths to maintain the shape of the tree, and facilitate the setting up of a

...m of fruit spurs along the leaders. By the time the trees are ... years old the building up of the spurs will be completed, and on ... the fruit will be produced freely during after years. The ...ers, if allowed to remain unpruned, also fruit freely on their ter...al buds. This has a stunting effect on the leaders and prevents ... symmetrical extension.

Plate 73 is a sixteen-year-old fairly vigorous-growing Rymer tree. Its branch system has been thinned out and the leaders have been shortened back on two occasions as the abrupt turns in the wood near their points indicate. These apparently objectionable turns in the leaders are produced through cutting to light laterals on the three or four-year-old wood and causing them to assume the leadership. Laterals so placed, and when utilized for the purpose mentioned, invariably describe a more open angle to the line of the leaders than do the

Plate 74.—Five Crown, seventeen years old, pruned.

primary growths, on the two-year-old wood, from which the leaders were originally lengthened.

PRUNING THE FIVE CROWN.

The Rome Beauty, for reasons already explained, figures prominently amongst the varieties which, from the scientific pruner's point of view, are the more difficult to shape into, and subsequently maintain, as the modern and approved type of apple tree, and consequently it has been made the subject of detailed illustration in this regard.

On the other hand, the Five Crown, on account of its naturally open habit of growth and free fruiting characteristics which make it the most prominent of these of the class more amenable to pruning treatment according to the modern design, has been selected and figured here to show the contrast which exists between the two classes.

When healthy Five Crown trees are planted out as yearling whip-growths, and when pruned so as to produce the three main arms which constitute the foundation of the branch systems, they invariably respond in the manner desired. And the yearly prunings to promote the necessary leader duplications afterwards are, as a rule, equally successful.

The leaders radiate from the crown at a nice angle about 40 degrees from the vertical. After pruning to two side buds on the leaders for the number of occasions necessary to produce the desired number of leaders, all that is necessary afterwards is to cut to outer buds to continue the leader extensions.

When the yearling extensions of the leaders are of reasonable length in proportion to the growth the tree is making, the leaf buds on these sections, except a few near the point of the leader, develop into fruit buds during the second year. Two or three of the buds near the terminal usually give lateral growths, but these are generally removed from the Five Crown, and others of similar habit in this respect, at the next winter pruning.

The fruit buds on the two-year-old wood of the leader, during succeeding years, develop into a system of fruit spurs which branch and extend to such an extent as to obviate the necessity of retaining the laterals.

When the habit of producing fruit spurs along the leaders in this way is discovered in any variety it should be, by judicious and systematic pruning, encouraged to the fullest extent, rather than to set up a system of fruit wood through the manipulation of the lateral growths. It frequently happens, when laterals are retained on the two-year-old wood, and particularly in the case of the Five Crown, that the previously developed fruit buds occupying lower positions on the leader, instead of extending into spurs, are pinched off. This happens because the laterals occupy the uppermost positions on the leaders, and thus deprive the fruit buds of the amount of elaborated sap necessary to lengthen them beyond the destroying influence of the extending and encompassing cambium and bark layers.

Plate 74 shows a seventeen-year-old Five Crown tree pruned. Eighteen leaders at first constituted its branch system, but the surplus ones have been thinned out in the manner previously described. The twelve retained are nicely spaced and well furnished with fruit spurs. The more equal in strength the portions of fruit wood in the tree the more uniform in size will be the fruit produced.

When the spurs become too crowded they may be reduced by thinning out the portions of each farthest away from the leader. The parts near the leader are equally as good for fruit production, and their foliage protects the bark from the sun scald, hot winds, &c. When produced on spurs of equal strength along the leaders in the manner described, and as shown on the tree in Plate 39, the fruit is more perfect in colour through the free admission of sunlight and air, it is of more uniform size and of better quality than when grown on trees pruned under the unscientific haphazard methods adopted by some orchardists. The adoption of the advocated method also renders the fruit and tree more amenable to spraying for Codlin Moth and Black Spot. The fruit is more easily picked, and the good results of manurial treatment applied to trees pruned in this way are usually more pronounced.

Plate 75 is a Five Crown tree twelve years old. Its cultural treatment and pruning have received careful attention during the whole life

the tree. It will be observed that the foliage of the fruit spurs affords a shelter, so essential during summer months, to the bark of trees growing under our warm climatic conditions in Victoria.

When the early pruning of a tree has been neglected to the extent of allowing it to develop a full centre, and it is afterwards decided to thin out the centre growths, this should be done gradually. The presence of the inner leaders prevents to a great extent the development of fruit spurs on the upper side of the outer ones. Consequently, if the drastic measures of removing all the centre leaders simultaneously were applied, the bark on the upper side of those retained would suffer from sun scald, which could be prevented by the more gradual renovation of the branch system. When a leader is removed occasionally, those which it is intended to retain are afforded

Plate 75.—Five Crown, twelve years old.

an opportunity to develop covering foliage for the exposed bark which becomes gradually accustomed to the sun's heat.

Biennial Cropping.

Almost all the varieties of apple trees cultivated in the different districts, with various soil and climatic conditions in Victoria, show a tendency to bear biennially or produce, normal conditions obtaining locally, a full crop of fruit only during alternate years. In some varieties the tendency is merely perceptible, while in others it has become a pronounced habt. This defect is not so noticeable in early ripening varieties such as Mr. Gladstone, Williams Favorite, and Duchess de Oldenburg, &c., as it is in late-ripening sorts like Five Crown, Rome Beauty, and Rokewood, &c. When trees are pruned

under the modern method the fruit is produced mostly on spurs, and at the base of the fruit stalks of this year are the fruit buds from which next year's crop is obtained. When the fruit is picked from the early-ripening varieties they are thus enabled, before the end of the growing

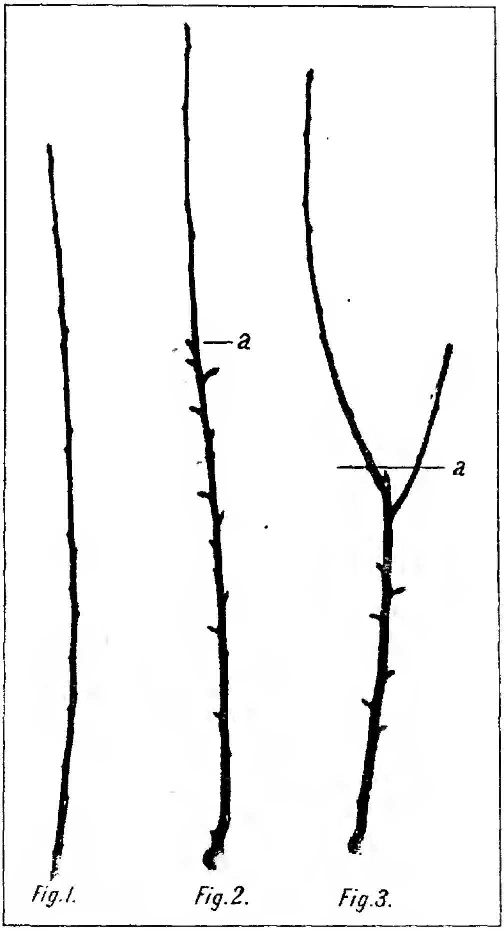

Plate 76.—Five Crown Lateral, showing development of fruit buds.

period, to strengthen the fruit buds for next year and to generally recuperate. With the late-ripening sorts, which bear heavy crops, however, the case is different, as they are compelled to support their fruit

ing the whole of the period of growth, and in consequence the fruit ... for the ensuing year have to suffer.

When dealing with the pruning of the Five Crown in the ordinary manner it was stated that, on account of the habit of the tree being to furnish its leaders with natural fruit spurs, the laterals may be removed. However, as the Five Crown is a pronounced biennial cropper, and as laterals under these conditions may be utilized to some extent to minimise this defect, those of the Five Crown afford the best illustration in this connexion, and consequently they have been selected. When a tree yields a heavy crop of fruit, it is usually produced on the spurs and laterals, when retained, over two years old. The tree should be kept in such a condition by pruning as to prevent its bearing an exceptionally heavy crop any year. A succession of growths eligible to bear on the off year may be maintained through judiciously manipulating the young laterals.

Plate 76 shows three Five Crown laterals which may be regarded as illustrating the method of obtaining eligible fruiting wood. Fig. 1 is one year old, showing leaf buds only, and it was produced during the year of a light crop. The next year, that of a heavy crop, it will furnish itself with fruit buds like Figs. 2 and 3, and thus be eligible to bear fruit on the following year of a light crop. If allowed to remain unpruned like Fig. 2 the stronger fruit buds will be developed near (*a*), the position of last year's terminal bud, but if pruned like Fig. 3 (*a*), stronger fruit buds will be built up near the base of the lateral. The phase of fruit-growing relating to biennial cropping has for some time received attention. Complete success in the matter has not yet been achieved, but the idea of procuring eligible fruiting wood in the tree is based on sound logical conclusions. Intense cultivation and the liberal application of manures are helpful, but the results of investigation and experiments are not sufficiently comprehensive to warrant a definite pronouncement in this regard.

Summary of Pruning.

In dealing with the subject of pruning it may be stated that varieties mostly showing distinctive characteristics, which embrace whole or in part those of all the varieties cultivated commercially in this State, have been chosen as illustrations.

It almost invariably happens that when illustrations are selected for the purpose of instruction the sequence observed is to commence with the simpler forms and to conclude with the more difficult ones. The sequence in this case, however, has been reversed, for reasons already explained, and it is thought that by so doing the desired object will be achieved.

In all probability the introduction of new varieties will accompany the increasing apple-growing industry in the Commonwealth, and their habits of growth, &c., will require to be closely watched so as to prevent the planting of inferior varieties, and to deal with their pruning requirements.

A single glance at a tree, whether he knows the name of the variety or not, is sufficient to enable a scientific pruner to determine its pruning needs.

(*To be continued.*)

SIDELIGHTS ON THE OLIVE OIL INDUSTRY.

By H. Pye, Dookie Agricultural College.

The probability that after the war Australia must be more self-contained than it has been in the past, prompts me to write a more discursive article on the olive oil industry, as applied to our conditions, than the usual technical articles published on the subject. The ignorance of the general public on the value of the olive is well known, and it appears to me that every effort should be made to inform the community at large, as well as the few whose business it is to know, of some practical benefits to be derived from a more intimate knowledge of the importance of the olive in the sphere of domestic economy.

I purpose giving some elementary information, as I am writing not for experts, but for the general farmer, and, incidentally, the man in the street interested in rural problems.

The olive tree will grow in practically every part of Victoria, and in almost all parts of Australia. In the more tropical parts the trees will grow well, but will not, as a rule, bear satisfactory crops. It is not likely large olive groves will be planted, as the labour conditions which at present obtain check any move in that direction; but if farmers can be induced to plant an acre or more, mills could be erected in central districts to which the fruit could be sent for oil extraction and pickling; though in the latter instance, owing to the fruit being damaged in transport, it would be better for the farmers and fruit-growers to pickle the olives themselves. To make the pickling industry pay, the popularizing of the olive as a food would need to be considered. For home consumption a few olive trees would supply sufficient fruit for pickling, and some for sale in the local town. When we consider that from ancient days the Latin races and others have made the olive one of the staple foods, it is surprising that its importance is not more appreciated in a country where it grows to perfection. The green pickled olive is eaten more as a condiment than as a food. The ripe olive, on the other hand, meets both requirements.

The olive tree is hardy, and, when once established, will live through the droughts. It would act as a shade tree or a wind break, and it could be grown alongside a boundary fence, thereby serving several purposes, as well as producing an economic product in its fruit. It adds also to the beauty of the landscape, and does not rob the soil as many other trees do.

Mr. L. Macdonald, of the Dookie Agricultural College, has published excellent articles dealing with the planting and other technical matter, and has also dealt with the problem affecting varieties. Over twenty years ago I established the oil industry at Dookie College in its present form. Several improvements could be recommended, especially the utilizing of hydraulic pressure as a quicker means of extracting the oil, and more of it. It is not generally known that the olive ripens its fruit in the late autumn and winter. The knowledge of this may make it practical for some farmers to grow the olive, as they may be less busy then, and could deal with a small plantation with the home labour

available. In a wider sense, were there large olive groves, the itinerant fruit-pickers would be enabled to have more constant labour, since they could continue their work after picking the late summer crops of grapes and other fruits, by picking the early varieties of olives during autumn, and the late varieties at winter time. This leads to the thought that the early varieties of olives should be planted in the one block, and the later in another, and so facilitate cultivation, and cheapen the cost of labour in picking. Another practical point gained by experience is, that it is much cheaper and less irksome to pick large-fruited varieties. It is one of those points where the human as well as the practical elements play a part. It is often said that the large varieties contain less oil. This may be true of many of the large varieties, but at the college, where some ten or more growers send their olives to be treated, the highest percentage of oil extracted is from a large olive grown at Mooroopna, and introduced, I believe, by Mr. John West over twenty years ago. Unfortunately, the name of the variety is not available. The fruit when green has an acrid bitter taste. As it ripens, it becomes a yellowish-green, then streaks of purple appear, and ultimately the whole fruit becomes dark-purple, and finally black when fully matured. The pulp when ripe varies from a light to a dark-purple, and in some instances it is quite black. As the fruit ripens it loses most of its bitter taste, and a few varieties are relatively sweet. In cold climates the olive is often sufficiently ripe for picking when yellow. The size of well-grown fruit varies from ⅝ to 1½ inches long, according to the variety. The stone varies in size in different varieties of otherwise similar dimensions. As the oil from the kernel is not as good as that from the pulp, the small-stoned varieties with relatively more pulp are, generally speaking, the better for commercial purposes, and, especially so for pickling. The shape and size of the stone give an indication of the name of a variety, as also do the shape and size of the leaf and the form of growth of the tree.

The proper time to pick the olives for oil extraction is just as they are ripe. They then have the maximum amount of good oil. As they become over ripe the percentage of oil present is less and of an inferior quality. Practically just as they become purple is the best time to pick the fruit, but in order to cope with a large area it is well to start when the bulk of the berries on the trees are purple. The oil made from such olives is more limpid, or what the trade terms thin, in contrast to a fat or thick oil, in which there is a higher percentage of stearine to olein or true oil. Every one who has seen olive oil in cold weather will have noticed the white solid matter thrown down. This is the stearine, and its presence is an indication that the oil is olive oil, or that the greater percentage of it is so. The stearine quickly dissolves when warmed. The higher the percentage of olein present the better the oil. The colour of the oil is an important matter in the commercial world. The colour depends on various conditions, viz.:—the state of maturity of the fruit, the variety, the season, and the soil. Olives picked over ripe give a dark-yellowish, unattractive oil, whilst those picked just ripe, or a little before, give a lighter coloured, limpid, and attractive oil, with a tinge of green in it. Heavy soils produce a darker, and generally inferior oil to those of a good loamy texture. With plenty of lime in the soil the oil is lighter in colour, bright, and more attractive.

Olives are sent to Dookie College from a number of different districts for oil extraction, and it is noticeable that the percentage of oil per cwt. of fruit varies considerably, also the flavour, even in the same variety grown in a different environment. Thus it may be inferred that each locality needs its special variety, and it would probably be an advantage if small plantations of different varieties were now formed throughout the State for future reference, when the growth of the olive will likely become more general. The trees, established in the dry areas of the State, would on account of their drought resistance and longevity, prove not only beneficial for shade purposes, but would also give some return.

The process of extracting the oil is a comparatively simple one. The olives are picked, and bruised as little as possible when handling. All leaves should be picked or winnowed out, and any dirt removed. The fruit is then spread on a floor to a thickness of 3 inches for some days. If the quantity of olives is larger than can be crushed and pressed before moulds appear, it should be sprinkled with salt and turned occasionally, otherwise the oil is apt to have a mouldy flavour. Though olives crushed just as they are picked give a finer oil, the process of extraction is much more difficult, as the slimy mucilaginous matter which runs out with the oil and juice prevents some of the oil from rising. By keeping the olives for several days on a floor, physiological changes take place within the olives which frees the oil from the mucilaginous pulp.

The first process in the oil extraction is to pass the olives through a machine that thoroughly macerates the flesh, but does not crush the stones. The pulp is then put in coir matting bags shaped like huge tam-o'shanters, or wrapped in esparte or other strong fabric. The bags are then put in the cage of the press, a steel plate and a wire mat being placed between each bag. The wires of the mat are about the thickness of No. 8 fencing wire. The part played by these wire mats is to facilitate the flow of the oil from the centre of the bags along the grooves formed where the wires touch the steel plates. If these mats are not used, owing to the pulp on the edges of the bags becoming so compressed, some of the oil from the centre does not get through, and so remains in the central mass of pulp. The oil from this first pressing is the finest virgin oil.

In the process of pressing the oil issues with the dark watery extract from the pulp, and is caught in a vessel at the mouth of the floor of the press. This is poured into a tinned vessel which has a tap a foot or 15 inches from the top, and a tap at the bottom to allow some of the liquid to run out when the tin is full. In order not to disturb the oil, which floats on the watery matter, the liquid from the press is poured into a funnel attached to a tube that opens at the bottom of the tinned vessel. When the oil has remained for a time in the tin the upper tap is turned and the oil flows into a similar vessel as the first, then washed in clean water. The oil is now passed through a filter of cotton batting, and afterwards forced through a thick wad of cotton batting in a specially-made filter, and allowed to remain for a time for any moisture or other matter present to settle. Small lots of oil are usually filtered through ordinary filter paper, when the oil comes out bright and clear, and ready for bottling. The oil should be exposed to the air or light as little as

sible. If exposed to the air it becomes rancid more quickly, and if exposed to light the chemical rays appear to act on it detrimentally. New oil is better than old oil, though many think that old oil, like old wine, is the better. The practical thought gained by this knowledge is, to buy just sufficient oil to last from one season to another. New oil, especially with a little sugar in it, is less nauseous to children, and is more palatable to those who drink it for gall-stones and other troubles; also, in that state it is more wholesome, and less given to cause digestive troubles. Poured on new bread with a little salt sprinkled over, it is quite palatable. Owing to the general ignorance of the difference between new and old oil, the more general use of olive oil in domestic economy is lessened. Much of the imported oil sold is on the old side, and is frequently adulterated with other oils.

Continuing the process of extraction, the pressed pulp from the bags, called the mare, is taken out and re-crushed in a Chillian mill. The stones are in this instance broken. A little warm water is added to the mare to replace the juice previously extracted, and the process of extraction goes on similarly as in the first instance. This gives a second quality oil which can only be detected from the first quality by an epicure. The temperature of the room in which the oil is extracted should be warm, otherwise the oil does not flow freely during the extraction. If the room is very cold, the oil extracted has a higher percentage of olein present.

In large factories the second mare may be again treated as above, or is subjected to the carbon bisulphide process to dissolve out the remaining oil, which is used for lubricating, soap-making, &c. The mare is fed to pigs, or for such purposes mixed with other food. It is apt to scour if fed by itself, owing to the oil present, and to the presence of the broken stones causing an increased peristaltic action on the bowels, and a freer flow of intestinal juices.

When the mare has been subjected to the carbon bisulphide process it may be sold as manure, as also may the liquid extract from the olives which contains a varying amount of potash salts.

No deleterious and unpleasant odours should be permeating the building in which the olives are stored, and in which the oil is made; also when sending olives to the factory the vessels should be perfectly fresh and clean, otherwise a distinct flavour and odour are given to the oil, and its market value is reduced.

The amount of oil extracted from 1 cwt. of olives varies from just over a gallon to 2 gallons, rarely more, unless the residual oil in the mare is extracted by carbon bisulphide, and as the best olives operated on here contained 44 per cent. of oil, and the lowest about 25 per cent., it follows that by the ordinary lever press used, only 18 per cent. to 20 per cent. of the oil of the best varieties is extracted. This includes the virgin oil and the second quality oil. With the relatively small quantity of olives operated on at the college, it does not pay to make a third crushing, or by means of carbon bisulphide to extract the remaining oil from the mare or cake. Where the olive oil industry is on a large scale it pays to extract all the oil, or as much of it as possible. The inferior grade oil could be used for lubricating, soap-making, burning, &c. I may mention here that a good night light may be

made as follows—pour some water in a glass, than add an inch or so of olive oil; cut a piece of tin and attach to it a piece of cork, form a little tube in which to place a short piece of wick, and pass it through the cork and piece of tin; light the wick, and it will burn for hours. By wrapping a piece of coloured tissue paper around the glass a subdued light will be obtained. The inferior oil made at the college is mainly sold to breeders who use it in getting pigs and sheep up for show. Possibly in large factories the marc and the juice could be treated for the salts and other extractive matter, and so cheapen the cost of extracting the oil.

Olives with a low percentage of oil and possessed of a small stone may make a good pickling olive. What is known as the French pickled olive is relatively small compared with the large Spanish olive. However, in France, Spain, and elsewhere both large and small varieties are used for pickling. The quality of the olive for pickling depends on the texture and flavour of the variety; and the shades of difference in the quality of the same varieties depends on the environment it is grown in, and the skill and attention involved in the pickling process. Olives are pickled either when green or when ripe. In order to get rid of the acrid bitterness in the green olives, they are steeped in a lye solution, preferably of caustic potash at the rate of 2 ozs. to the gallon of water, though caustic soda is also used. The olives are steeped in the lye until the acridity is unnoticeable. Care should be taken not to allow the olives to remain too long in the lye. From twelve to twenty-four hours is usually long enough. By tasting the olives the right stage may be determined. The lye is then run off, and it is replaced by fresh water to wash out the remaining lye. It is better to let the water run on the olives from a tap, otherwise frequent changes of water are necessary. It will take several days to wash out the lye. For ripe olives very weak lye solutions should be used, since, as the olive ripens, the bitter taste becomes less pronounced, and, in very ripe olives, is almost absent. The olives are now ready for a weak brine containing about 4 ozs. of salt to the gallon of water. On the second day pour off the brine and add a fresh and stronger one of from 6 to 8 ozs. of salt to the gallon and allow the olives to remain for about a week, then make a brine of from 10 to 12 ozs. of salt per gallon of water and leave for a fortnight. Sometimes less trouble is taken and only two changes made. The final process is to boil a brine solution made by adding 14 ozs. of salt to the gallon of fresh water, and pour it over the olives. The olives should be kept under the brine, otherwise those exposed to the air blacken. This also applies to the olives when in the lye. Again, the vessels used in the pickling process should either be wooden, glass, or earthenware. Metallic vessels should not be used. When bottling the olives, take them from the tub or crock and fill the bottles with them, and then pour in a freshly-boiled brine solution of similar strength to the last until the olives are covered, after which cork tightly. Should the olives become very soft and break up into a mushy consistency, it indicates that the lye was too strong, or the olives remained in it too long.

STATISTICAL INFORMATION AND COMMENT ON SAME.

With the exception of South Australia, none of the States manufacture olive oil to any extent. In Victoria, olive oil has been made at the Dookie Agricultural College for 30 years or more; the olivetum of about

res was planted in 1879 by the late Mr. J. L. Thompson, a former ...cipal. The greatest output of olive oil from the college was ... gallons. This included oil made from the olives sent by various ...ers. Messrs. Docker Brothers, of Bontherambo, in the north-east ... this State, were the earliest to establish an olive plantation; but the ... of picking, at the then comparatively low price of the oil, checked ...ther enterprise. The Mildura plantations have been for some time in bearing, and an excellent oil of fine colour is made there. At the Wagga Experimental Station, in New South Wales, there is a fine selection of olive trees.

I am under obligation to Mr. G. H. Knibbs, C.M.G., the Commonwealth Statistician, for the following data, kindly supplied in respect to the olive oil industry of the Commonwealth; and also the statistics relative to the importation of the vegetable oils. There is only one manufacturer of linseed oil in the Commonwealth, and the oil is manufactured mainly from imported seed. There is also one factory in Victoria, which I believe is managed by an old Dookie student, where castor oil is made from imported seed.

The following statistics relative to the olive oil produced within the Commonwealth is interesting when taken in conjunction with the annual imports of this oil. It shows how much the Commonwealth is dependent on other countries, mainly Italy and France, for its supplies when it is quite possible to furnish its own, and possibly some for export:—

PRODUCTION OF OLIVE OIL WITHIN THE COMMONWEALTH.

	Gallons.
1908	12,998
1909	16,464
1910	26,340
1911	7,817
1912	3,762
1913	26,972
1914	3,000 (approximately)

THE IMPORTS OF OLIVE OIL INTO THE COMMONWEALTH DURING THE LAST THREE YEARS.

Year.	Gallons.	Value.
1913 ..	59,221 ..	£19,304
1914-15 ..	67,825 ..	£21,079
1915-16 ..	119,087 ..	£41,187

IMPORTS OF OLIVE AND OTHER VEGETABLE OILS (IN BULK) DURING THE LAST THREE YEARS.

Kind of Oil.	1913.		1914-15.		1915-16.	
	Gallons.	£	Gallons.	£	Gallons.	£
Olive	59,221	19,304	67,825	21,079	119,078	41,187
Castor ..	294,277	40,782	268,582	35,320	158,500	22,953
China ..	100,428	15,264	81,157	11,289	105,926	14,574
Cocoanut ..	1,784	379	1,596	303	2,903	557
Colza ..	117,164	14,421	150,179	18,155	165,835	23,637
Cotton Seed ..	145,380	19,657	157,116	24,286	260,908	45,348
Linseed ..	1,480,503	192,629	992,874	123,866	1,055,120	153,641
Totals ..	2,207,757	302,436	1,719,329	234,304	1,868,270	301,897

It will be seen from the above table that the value of imports in vegetable oils is gradually increasing, and especially so of olive and cotton-seed oils. No doubt some poppy and other oils are also imported and a certain amount of olive oil in bottle. The high price of olive oil that obtained during the last few years no doubt leads to a certain amount of adulteration with cheaper oils. Twenty years ago olive oil was selling wholesale at from 6s. to 7s. 6d. per gallon. To-day it is 13s. to 13s. 6d. per gallon, with perhaps a little more for a specially fine oil.

The table giving the production of olive oil within the Commonwealth shows a wide variation in the output of the different years. This no doubt is mainly due to the light rainfalls, and to a heavy olive crop being usually followed by a poorer one the following year. This latter state is possibly more due to the little attention paid to pruning the trees. In seasons when the effective rainfall is very low, new wood is not formed to any extent, and so succeeding crops suffer, whilst any fruit formed is undersized. In irrigable plantations this is not so manifest, but as the bulk of the olive plantations are not situated in irrigable areas, the fluctuations in yields are accounted for. Every encouragement should be given to the planting of olive trees in the irrigable areas, as in the years to come they will not only be productive of wealth, but they lend a charm to the landscape, as well as act as wind breaks and shade. With the advent of the great war, a looking forward policy is essential in every branch of rural economy. The many letters from the volunteers from rural districts at the front, are replete with observations of the agriculture and horticulture of other lands, and many of these soldiers are seized with the importance of what may be termed the minor rural industries to the countries they have seen.

In regard to the olive, its more general growth would lead to its more general use in domestic economy, as it will be produced more abundantly and cheaper.

In respect to the other oil-producing plants and trees, the Commonwealth, with its wide variation in climate, from tropical to sub-tropical, could produce most of the oils now imported. At present the cost of labour is the great drawback; but, with many small areas devoted to the growth of these plants, and with factories established in central districts, much more could be done than at present obtains. It is here the rural schools may play a fine part in making the child, and ultimately the man, familiar with the oil-producing plants, and incidentally with their worth. This, combined with the good work done by the Agricultural Departments of the several States, would do much to dispel the want of faith in such industries. Again, the Governments of most countries which have the right climate and soil have their parts to play in making the conditions favorable for the establishing of new industries.

If we take the production of linseed as an example, it will be found to grow well in most parts of Victoria, if judgment be used in the preparation of the soil and the time of sowing the seed. In the north, it needs to be sown early—from the middle of April to the middle of May—but, as wheat is the standard crop, linseed is only considered as a side issue, and is neglected. With the rise in the price of meat, it is possible that more attention may be paid to the growing of small areas of linseed, and a certain amount of hand-feeding for topping off live

...ork is likely to become more general. The increasing cost of binder ...d other twine will also have its effect on the future of the industry, ...d also give a stimulus to the manufacture of linseed oil and the ...tilization of the oil cake in the State for stock feeding.

The growing of essential oil and medicinal plants, and plants from ...hich flavouring extracts are produced, would interest women whose ...clinations trend towards rural work, and would also interest men ...hose strength does not admit of the more arduous labour in the fields. When it is considered that over £300,000 worth of vegetable oils were imported last year into the Commonwealth, exclusive of essential oils, it shows that much wealth could be retained in the Commonwealth, not only on account of the oils, but also the by-products that could be used for the encouragement of a higher form of stock feeding. It is more than likely, too, that after the war these imported products will be dearer, and that the annual amount of money sent to other countries will increase, unless effort be made to establish oil and other minor rural industries within the Commonwealth.

Experiments show that sheep require about 2lbs. of water for 1 of dry food, horses 2 or 3 to 1, and cattle 4 to 1. Pasture grass contains 70 to 80 per cent. of water in the green state.

In 1911 there was 1 acre under crop for every 14 acres in Victoria. In Tasmania the proportion was 1 acre to 58; in New South Wales 1 to 59; in South Australia 1 to 89; in Queensland 1 to 643; and in Western Australia 1 to 730.

When a crop is saved for seed purposes from clean, well-tilled land, the resulting seed will be freer from the seeds of weeds—and this is, perhaps, particularly important in the case of the cereal grains, which are more often saved for seed than any other crop.

Every farm boy has wondered which horse pulls the greater share of the load, the fast one or the slow one. The Iowa Agricultural College states that the heaviest end of the load falls to the slow horse. In case the fast horse is eight inches ahead, for example, the rear horse pulls 6 per cent. more than the faster one.

Wool contains suint, fat, and pure wool hair. The suint consists chiefly of a potash compound, and is mostly removed when sheep are washed. The suint may form more than half the weight of the fleece, or may be only 15 per cent. The fat is not removed by washing, and may vary from 30 to 8 per cent. of the washed fleece.

THE VALUE OF A PURE-BRED DAIRY SIRE.

By R. R. Kerr, Dairy Supervisor.

Of the many desirable changes in the evolution of the dairying industry, nothing is more needful than a closer perception of the principles governing the breeding and management of our dairy cattle. Many useful articles have from time to time appeared in the pages of this *Journal*, but evidently it is only by keeping this matter in the limelight that the desired results will be achieved.

No business institution would long remain solvent if worked on the same lines as many farmers conduct theirs—many appear to pay their way—the farmer forgetting the value of his own labour and ofttimes that of his children.

We do not expect that every farmer should be an accountant, nor yet understand all of Mendel's theories, but he should practise the fundamental principles of his business, and be a closer student of economics.

The use of mongrel or crossbred sires is a costly procedure, resulting in continual depreciation of our dairying stock; it cannot be denied that dairy cattle in some of our dairying districts are not as good a type as they were a few years ago, the result of using inferior bulls.

A visit to a district where the farmers are aware of the value of a pure sire, and act on their opinions, is a revelation. Such was my privilege recently. The results proved what an immense amount of benefit the stud dairy herds exercised in that district. The farmers secured the young bulls at a fair price, and a mongrel sire was seldom seen. Jerseys seemed to be the mainstay, but the results would be just the same with other breeds if the opportunity had occurred. A dairy herd may be able to withstand temporarily one or two robber cows—all untested herds do—but no stock-breeder will ever achieve much success by the use of an inferior sire.

The robber cow exercises her influence only over her own progeny, but, in the case of a bull, his influence for good or evil is distributed through every calf that he sires—perhaps fifty in the course of a year.

There is no excuse for any farmer selecting bulls from untested cows, as the Government herd test records provide a wide field for selection in that direction.

Frequently dairymen hold the shilling so close to the eye that it is impossible to see the pound a little further off, and that is just what a man is doing who has a good grade herd, and thinks he is economizing by buying and using a common sire. The average-sized dairy herd would be about 40 cows in the main dairying districts, and probably twelve heifer calves would be reared from the best cows, and at least ten of them would inherit the great producing ability of the sire's dam and grand-dam if he was of the approved type.

A good dairy sire will remain useful up to eight or ten years or more if judiciously used, but for the present we will assume he was used for three years by Mr. Smith, who had a very good grade herd, averaging annually over a number of years 500 gallons of 4 per cent. milk (considerably above the State average). Mr. Smith fed his cows very well, he had been using an ordinary bull, and noticed the resultant progeny were no improvement, and in many cases lower producers than their dams.

In January, 1910, he noticed Mr. Brown was advertising a fine young Jersey bull, whose dam made 450 lbs. fat and grand-dam 400 in the nine months under Government Herd Test. The same high producing powers were on the sire's side. Mr. Smith, in common with other dairymen, thinks the price asked, £50, is too high, but at length determines to make the investment, and secures the animal. He realizes that he will have to wait three years until the bull's progeny begin to yield a profit, but, being a good dairyman, knows that it is no use depending on other farmers for dairy cattle.

1910.—40 cows, including 10 heifers by crossbred sire (averaging 200 lbs. fat at 1s.), £400. (They were mated with pure approved sire.)

1911.—40 cows, including 10 heifers by crossbred sire (averaging 200 lbs. fat at 1s. per lb.), £400. (Again mated with approved sire—best 12 calves reared.)

1912.—40 cows, including 10 heifers by crossbred sire (averaging 200 lbs. fat at 1s. per lb.), £400. (Again mated with approved sire—best 12 calves reared.)

1913.—40 cows, including 10 heifers by approved sire (these 10 heifers show an increase of 50 lbs. fat over previous heifers, at 1s. per lb., £2 10s. each—£25), £425. (Again mated with pure sire.)

1914.—40 cows, including additional 10 heifers by approved sire, making 20 (showing an increase of 50 lbs. fat each, at 1s. per lb.), £450. (Again mated with pure sire.)

1915.—40 cows, including another 10 heifers by approved sire, making 30 head (showing an increase of 50 lbs. fat each, at 1s. per lb.), £475.

Six years have now elapsed since the approved bull was selected and bought, and the returns have increased by £150.

Six years when old common sire was used, £2,400.

Six years from time of purchasing approved sire, £2,550.

Difference in favour of new bull as result of three years' service, £150.

Comparison cost of providing every heifer with parent:—

——	Pure-bred.	Scrub.
	£ s. d.	£ s. d.
Cost of sire	50 0 0	10 0 0
Interest, three years, 5 per cent.	7 10 0	1 10 0
Cost of keeping, three years..	18 0 0	18 0 0
Total cost at end of three years	75 10 0	29 10 0
Minus value at end of three years	40 0 0	10 0 0
Actual Cost	35 10 0	19 10 0

The cost of the pure sire was £35 10s., the cost of the mongrel £19 10s., being a difference of £16, allowing for the 30 heifers reared during the three years. The heifers by the approved sire cost 10s. 8d. each more than those sired by the common bull. When the comparisons are made, the extra cost of providing the heifers with a good sire is 10s. 8d.

As the milking life of a cow can be safely placed at six years, and these heifers had an annual increase each of 50 lbs. fat, or 300 lbs. in the six years, at 1s. per lb., £15.

The heifers yielded an additional £15 as the result of 10s. 8d. expended in the pure sire. When this £15 is placed on each of the thirty heifers, the total increase is £450, as the result of selecting a bull that had the power of transmitting the producing qualities to his offspring. When we think of the first cost of £50, it is infinitesimal when compared with the ultimate result.

Can any other item in farming show a better profit? Considering the male calves as of no more value than those sired by the scrub, and the remaining heifer calves on the same level, it is a splendid investment. It really pays as *nothing* else pays to put £50 into the purchase of the right kind of sire that will return nine times £50 in the course of three years of service.

When it comes to the production of milk the profits are still greater. If the pure sire was the means of increasing the heifer's production by 1½ lbs. a milking, in the course of 300 days this would mean 900 lbs., at 8d. a gallon, £3 per head, or £18 in six years, making £540 total increase for thirty cows sired by the selected bull.

A herd of forty cows is taken as an illustration, while a vigorous sire, properly fed and managed, kept apart from the herd, is capable of sixty cows. There is another distinct improvement of the good sire's daughter, besides her milk production, and it is the improvement of her blood for breeding, by which her daughters should be still better producers. This improvement of all the daughters accumulated through a series of years means a remarkable increase in the efficiency of the herd.

It is the experience of all dairymen who have used a really good dairy sire, that the investment has made them splendid returns.

But a great amount of attention must be paid to the sire's selection as regards family production, breeding, and constitutional fitness. The £50 cost price looks "too big" only to the narrow vision that cannot see the natural improvement of the herd certain to follow. Many a farmer might have reason to say he cannot afford to pay a big price for a fine cow, but the same argument does not hold good in the purchase of an improved sire, because the sire's influence spreads so much further and faster than the cow's.

If the heifer calves are to be raised for dairy purposes, there is no business reason for keeping a mongrel bull. The dairymen who think there is pay a heavy price annually for maintaining that tradition.

The crossbred bull is the most expensive animal on the farm; he does not remain at being worthless, but will lose the farmer the price of a good bull every year he is kept. The dairymen cannot afford to keep mongrel bulls if they were given them, and if they they were paid a premium to keep them; they are only fit for sausage meat, and it is high time this plain and simple truth were given practical acceptance on every farm.

The presence of so many crossbred bulls in the State—many times without a single qualification, except that they are males—is an offence and disgrace to the dairy business—a plain advertisement of the dairymen's thoughtless bid for failure. By all means secure a good dairy sire, if you have to sell two or three cows to do it. The improved sire is, without question, the most economical investment in any dairy herd

NHILL AGRICULTURAL SOCIETY ANNUAL CROP AND FALLOW COMPETITIONS, 1916.

Report of the Chief Field Officer, Mr. Temple A. J. Smith.

The President,
Nhill Agricultural Society,
Nhill.

DEAR SIR,

In submitting my report on the Crop and Fallow Competitions for 1916, I would like to congratulate your Society on the fact that your district has been favoured by such an excellent season as that just experienced. It speaks well for the soundness of your portion of the Wimmera when it is possible to state that with the exceptional rainfall and generally favorable weather for the development of fungoid diseases, such as rust, take-all, and smut, the crops have, in 90 per cent. of cases, escaped injury and though traces of all these diseases were found to be fairly plentiful, the bulk of the crops inspected will produce fine, plump, clean seed, and there appears every prospect of record yields being obtained in several cases. Oat crops were not as fine as last year's, though many good crops were seen, and the difficulty in getting them off at the right stage of ripeness, owing to the surplus moisture in the ground, will affect returns from this cereal. The Barley crop is only a side issue in the Wimmera, and a very small area was to be noticed growing; this crop has also been affected by the protracted wet season. There is, however, an abundance of grass and wild oats, the greater part of which will probably be wasted instead of being cut for hay and stored for future use in times of drought. The very fact that hay made from self-sown stuff is practically immune from attack by mice, and is so relished by stock, appears an argument in favour of its being utilized to a greater extent than is at present the case; and when, in addition to these advantages, the actual cutting of the wild oats on the green side is an advantage in rendering the ground cleaner for future crops it is somewhat remarkable that the practice of making larger quantities of self-sown hay is not more generally adopted.

PREVIOUS SUGGESTIONS ACTED UPON.

Perhaps one of the most pleasing features noticeable on this occasion was the adoption of several suggestions made on previous visits. It is an old, but trenchant, saying, "that the onlooker sees the best of the game," and it is quite possible that a newcomer may see fresh fields for development which might escape the local resident.

Tests have been made with early summer fallow as against late fallowing, and results prove that the former system should be more generally practised. Over a radius of some 40 miles on various kinds of soil, early summer fallow was found to produce cleaner and heavier crops, and also much greater freedom from disease. Take-all and Deadheads showed to a far greater extent on stubble land and late fallow, and the additional labour involved in early fallowing is more than compensated for in the additional crop harvested.

Tests carried out by the Department of Agriculture disclose excellent reasons for these beneficial results; early fallowing induces much larger supplies of nitrogen in the right form (the nitrate). The additional working of the soil releases a greater amount of phosphoric acid

and potash, a better and more compact seed bed is made, and weeds and rubbish are eradicated to a greater extent.

In one instance a strip of summer fallow was observed between two others of winter fallow on the same kind of soil, all sown with the same seed and manure, and at the same time—the early fallow being cleaner and heavier, freer from disease, and the difference in appearance very noticeable directly the boundary line between the areas so treated was reached.

Heavier applications of manure also showed to advantage, 75 to 80 lbs. being used with good effect. Dead-heads were less plentiful where heavier dressings were used, and the crops further forward in condition.

On one farm, and that a small one, four nice stacks of self-sown hay aggregating about 200 tons were conserved awaiting their turn to establish a reputation for saving life and money.

Mr. David Bone, senior, was visited, and cannot be too highly recommended for pioneering the way to introducing lucerne plots under irrigation. Four acres had been sown, and a nice stand of young lucerne was in evidence; this is to be extended to 10 or more acres later on. A dam with a storage capacity of 180,000 cubic feet had been constructed on the edge of a large swamp, from which the water supply can be augmented by pumping with a 3-inch pump as required, commanding the lucerne plot.

There are many places in the Nhill district similarly situated, and with the aid of bores the water supply could be further supplemented. No better insurance against loss of stock in times of drought can be imagined, while in times of plenty the increased numbers of sheep and cattle carried will add to the profits of the farmer in normal seasons, and pave the way for the production of intense culture as applied to new agricultural industries which can be made highly profitable on smaller farms than are now necessary.

Crop Competitions.

FOR BEST HALF OF WHEAT CROP, NOT LESS THAN 75 ACRES.

Maximum points, 100.

Name.	Location	Weeds.	Disease.	Purity.	Evenness.	Yield.	Total.
O. H. Lienert	Lorquon ..	14	14	19	14	34	95
G. Crouch	Kaniva ..	13	14	18	13	34	92
R. Blackwood	Kiata East ..	14	14	17	13	33	91
Mrs. A. P. Dufty ..	Lorquon West	13	13	17	14	32	89
E. J. Hoffman ..	Winiam ..	13	13	16	13	30	85
W. E. Dahlenburg ..	Salisbury ..	13	14	15	12	28	82
R. N. Williams ..	Kaniva ..	13	12	17	13	27	82
H. Scroope	Diapur ..	13	13	17	11	26	80
A. W. Goodwin ..	Kaniva South	13	11	17	11	28	80
Alf. Schultz	Woorak ..	11	13	16	12	27	79
Frahn and Gladigau ..	Winiam ..	13	11	16	11	26	77
P. Bone, Junr. ..	Kiata East ..	13	10	16	11	27	77
J. J. Meagher	Lawroit ..			(Withdrawn)			
D. Jones*	Haycroft ..	14	13	18	14	34	93

* This competitor had only 135 acres of crop altogether, half of which amounted to less than the stipulated 75 acres.

Mallee Section.

Best Growing Crop of 100 Acres.

Name.	Location.	Weeds.	Disease.	Purity.	Evenness.	Yield.	Total.
Mrs. A. P. Dufty ..	Lorquon ..	13	13	17	14	32	89
[illegible] and Schultz ..	Glenlee ..	13	13	17	13	30	86
Mrs. M. McKenzie ..	Glenlee ..	12	11	16	12	28	79

Best Crop on 1915 Fallow, Judged 1915.

Fallow and Crop Points to be Added Together.

Crop 1916.

Name.	Location.	Weeds.	Disease.	Purity.	Evenness.	Yield.	Total.
R. Blackwood	Kiata East ..	14	15	17	14	34	94
G. Crouch	Kaniva South	13	14	18	14	34	93
E. J. Hoffman ..	Winiam ..	13	13	16	13	30	85
P. Bone, Junr. ..	Kiata East ..	13	12	16	12	28	81

—	Fallow, 1915.	Crop, 1916.	Total.
G. Crouch	90	93	183
E. J. Hoffman	95	85	180
R. Blackwood	82	94	176
P. Bone	92	81	173

Best Fallowed Land—100 Acres.

Name.	Locality.	Moisture.	Cleanliness.	Mulch.	Cultivation.	Total.
R. G. Kram	Woorak ..	25	24	24	24	97
O. H. Lienert	Lorquon ..	25	23	23	23	94
R. Blackwood	Kiata East ..	25	22	23	22	92
W. E. Dahlenburg	Salisbury ..	25	21	22	22	90
G. Crouch	Kaniva South	25	21	21	22	89
E. J. Hoffman	Winiam ..	25	22	20	20	87
D. E. McKenzie	Glenlee ..	25	18	21	21	85
A. W. Goodwin	Kaniva ..	25	18	20	20	83
P. Bone, Junr.	.. ..	(Withdrawn)				

THE CROPS—1ST SECTION.

Best Half of Crop.

Judging the crops on this occasion present some difficult problems, inasmuch as the weather had prevented roads being cut round and through the crops; travelling also had to be done by means of horses and buggies, it being impossible to use motors, and the crops themselves were of such splendid character that it was difficult to discriminate. In almost every exhibit portions of the crops shown were simply magnificent, and it was only in taking them in the whole area specified that some stood out above others.

Mr. O. H. Lienert takes first prize in this section with a wonderful crop of Yandilla King, "a crop worth going a long way to see," splendidly headed, thick and well grown, clean and very true to type, showing promise of an unusually heavy yield. There were 100 acres of this variety, and also 40 acres of Federation almost equal in quality to the first, the balance of his crop being excellent, with the exception of about 30 acres which had suffered from too much water.

Flag rust was noticeable fairly generally, but not in sufficient quantity to do any damage. Mr. Lienert is to be congratulated on his success, which is well deserved, all his work on the farm showing careful forethought and thoroughness.

Mr. G. Crouch, of Kaniva South, is again well up in this competition, coming second, a highly-creditable performance when his area is taken into consideration (600 acres). It is obviously of greater merit to take a prize for the best half of such an area than for that of 200 or 300 acres, and under the circumstances Mr. Crouch has put up an excellent performance, and should be well rewarded by his all-round average which cannot fail to be very fine indeed.

A portion of his crop is on land that has been under cultivation for thirty-five years, subject to the usual Wimmera rotation. Formalin pickle is preferred to bluestone on this farm, and seeding and manuring at the rate of 50 lbs. per acre in each case.

The bulk of the crop is Federation, but a nice crop of Commonwealth was also in evidence. Mr. Crouch feeds off with sheep, and is a firm believer in early summer fallow and May sowing. Crops of College Eclipse and Gluyas were also seen on this farm, the former growing rather too much straw, and the latter very weak in the straw, and going down rather badly. On the whole Mr. Crouch prefers Federation to any other variety so far experimented with.

Mr. R. Blackwood, who comes third, is another farmer who promises to take a leading part in these competitions. Though only a few years in the district he is already showing a good example to others in his methods and results.

Crops of Federation, Moira, Currawa, and Penny wheats were all good; both Moira and Currawa were, however, weak in the straw and inclined to lodge; this was noticeable in other crops of the same varieties, excepting in the case of Currawa on Mallee land, which looked exceedingly well.

Mr. Blackwood is a believer in harrowing crops, and uses a bushel of seed per acre, with 60 lbs. of manure: he also grades his seed, which is a practice more farmers might indulge in with advantage. He uses bluestone pickle at the rate of 2 lbs. to 10 gallons of water.

Mrs. A. P. Dufty, though not a prize-taker in this section, scored a triumph in beating, with a Mallee crop, many of the other competitors.

All the remaining exhibitors showed fine crops, some of which contained too large a number of Dead-heads, which were always worst on late fallow, stubble land, or on lightly-manure applications. Smut was fairly prevalent in a few crops, and a little rust in many; in one or two cases the stalks had been affected rather badly.

MALLEE SECTION—BEST 100 ACRES.

Mrs. A. P. Dufty was easily first here with a beautiful crop of Federation which was level, even, well-filled, and very clean—a crop to be proud of, and one that will yield exceptionally well—an estimate of eleven bags per acre being, I think, under the mark. On this land 50 lbs. of super. and 50 lbs. of seed were used, sown in May, pickled with bluestone, 2 per cent. solution.

Nine acres of Penny wheat on this farm compared well with the Federation, and the seed had all been bespoken by neighbouring farmers, which speaks well for this new variety.

Mr. A. G. Schultz, of Glenlee, came second with a very nice crop of Federation. He uses 60 lbs. of super. and a bushel of seed. He harrowed 20 acres, and was of opinion it improved his crop.

Mrs. McKenzie's crop was not up to previous years' exhibits.

BEST FALLOWED 100 ACRES.

Mr. R. G. Keam, Woorak, wins in this section with a beautiful bit of fallow, on which two teams were just finishing a final touch up. This land had been ploughed once, harrowed twice, and cultivated twice, and was in tip-top order.

Mr. O. H. Lienert came second with an excellent piece of work, with not quite as good a mulch as the former, and slightly behind in cleanliness.

Mr. R. Blackwood was third with another fine piece of work which, had it received another stroke of the harrows just previous to inspection, would probably have won.

Many excellent fallows were seen, the moisture content in all being most satisfactory, due to the wet season. Taken all round, splendid work had been done, as the year was all in favour of weeds and wild oats, and the shortage in sheep rendered the cleaning of the fallow still more difficult. Added to this trouble it was not possible to get on to the land at times owing to the exceptional wet weather—the sandy soils scoring in this respect over others.

BEST CROP ON 1915 FALLOW.

Crop and Fallow points added together.

Mr. G. Crouch, Kaniva, comes first in this competition, his crop on this special fallow being very fine—all Federation—while Mr. R. Blackwood, with an equally good crop, comes out on the total third on the list, owing to a rather low percentage of points for his fallow in 1915.

E. J. Hoffman scored well for his fallow in 1915, but not so well for his crop this year. However, his points balance up well, giving him second place in the total.

GENERAL IMPRESSIONS.

Having had the opportunity for the third time of judging in the Nhill Farm Crop and Fallow Competitions, in normal, and also in abnormally wet and dry seasons, my impression of the soundness of your district has been considerably enhanced. Other parts of this State and Southern New South Wales have suffered severely from fungoid diseases in the crops this year, while such is not the case in the Wimmera. Sheep are reported to be suffering from lung troubles and foot rot also elsewhere, which, however, is not the case here.

Several new comers to the district expressed themselves as highly satisfied with their choice of a farming district, and some of these were men with wide experience of the State. Older residents continue to make further improvements to their holdings, and, generally speaking, an air of prosperity is observable everywhere.

SUGGESTIONS FOR THE FUTURE.

One fact stands out prominently in the present season in connexion with farming pursuits, and that is the necessity for more sheep. Many cases were noted where the operation of fallowing had been more or less wasted owing to the scarcity of sheep for feeding off the sprouted oats, &c. For successful wheat farming, sheep in the proper proportion are indispensable, apart altogether from the profit in the sheep themselves, and an effort should be made by Wimmera farmers to increase the carrying capacity of their land in this respect. This can be done by conserving more fodder for bad times, both wild oaten hay and ordinary hay. Oats alone fed to sheep are worth more than the average market price paid for them; $\frac{1}{2}$ to $\frac{3}{4}$ lb. of oats fed per sheep per day will keep them going well. Immense quantities of hay are wasted every good year by being allowed to rot on the ground, which it would be an actual advantage to cut on the green side for the sake of the wheat crops to follow.

Additional fodder could be provided in small lucerne plots wherever suitable, which could be still further augmented by the growth of sorghums, especially where small quantities of water for irrigation are available. Wool and mutton are likely to remain at high prices for many a year, and make the prospect of lamb raising and sheep breeding very good. All the leading farmers are unanimous in respect to the necessity for something in this direction, and a few are taking steps to further the carrying capacity of their holdings.

Early fallowing has proved advantageous in both dry and wet seasons, and should be a practice more generally followed; increased crops, less disease, and greater security in getting a crop in bad seasons would result.

Heavier manurial dressings should be used, and instead of 40 to 60 lbs. per acre, 75 to 100 lbs. would tend to larger profits. There will be many 30-bushel crops this year, which means that phosphoric acid will be removed from the soil equal to the amount contained in at least 1 cwt. of superphosphate. Moreover, to starve the soil or crop for its necessary complement of super. is limiting its producing capacity, and lessening the probability of a full return for the labour and expense involved in fallowing, sowing, &c.

The growth of onions, tomatoes, and other vegetables, in many of the gardens visited, opens up the question as to whether it would be

. th while to grow small areas of such crops for supplies of this kind ... the metropolis.

Such things are done at Echuca and other northern places where ... and climatic conditions are certainly not any better than those in t. Wimmera.

In conclusion, I must thank your Society for the honour conferred upon me in requesting my services as judge for the third time in succession, but, much as I appreciate the compliment, I am doubtful if it is altogether wise to have the same or any judge too often in the interests of the competitions, and I would suggest that a change be made, at any rate, for a year or two. On this occasion a representative of one of the leading Melbourne weeklies went right through the programme during the judging, and expressed himself as delighted with the experience gained. Such a precedent would be a wise one to follow in future years, and an invitation from your Society to other leading weeklies might lead to further advertisement of the Nhill district.

I sincerely thank those gentlemen who so kindly conveyed the party from place to place, and also those who so hospitably provided entertainment.

Excellent arrangements were made by Mr. Towns, your Secretary, for the conduct of the judging campaign, much of the success of the competitions being dependent upon his indefatigable efforts, which I believe have been instrumental in carrying them on for the past sixteen years.

Yours faithfully,
TEMPLE A. J. SMITH.

NEW FERTILIZER.

Experiments have recently been made upon the fertilizing value of sodium ammonium sulphate as compared with ammonium sulphate.

Owing to the scarcity of sulphuric acid sodium bi-sulphate is being used to a large extent to absorb ammonia. The material with which the experiments were made contained 9 to 10 per cent. nitrogen. and the crops treated were rye, oats, barley and several varieties of beets and cabbage. In every case ammonium and sodium ammonium sulphates gave practically the same yields when equivalent amounts of nitrogen were applied.

Extract from Journal Ind. and Eng. Chem., Vol. 8, No. 11, Nov., 1916.

Ammonium sulphate is manufactured in Victoria. The supply is more than equal to the demand. In the face of the recent remarkable advance in price of this artificial fertilizer the above extract may provide material for consideration.

SUPERIOR QUALITY OF VICTORIAN GRAIN.

That Victoria produces better wheat and oats than California was demonstrated in a conclusive manner on a recent occasion, as borne out by the illustrations submitted herewith, the originals of which are now in the possession of the Director for Agriculture, having been handed to him by Mr. F. T. A. Fricke, who was, until recently, representing this State in North America:

Views of the Exhibit.

In addition to the usual agricultural shows ("State Fairs," as they are called in America), land shows are also held at favorable times.

At the last Californian land show held in San Francisco the opportunity was taken for a small display as an information office for a general advertisement by Mr. Fricke, using for decorative purposes a quantity of bottled grains and heads of varieties of wheat and oats, prepared by the Department of Agriculture. As usual, large booths and displays

were shown by practically all the counties of California, and the affair was a huge success, being a glorified exhibition of everything that the State produces, backed up by the friendly rivalry existing in the various sections, each endeavouring to advance their district by all the "boost" possible.

The usual gold, silver, bronze, and honorable mention were the awards offered. Occasion was therefore taken to enter the Victorian grains, but the show was very meagre as compared with the opportunity

afforded for collection of the local products. Satisfactory to relate, though somewhat surprising in view of the complete displays entered by the various sections of California, and the strong local interest in the undertaking, the highest awards of gold medals and blue ribbons were obtained in each instance for wheat and oats grown in Victoria.

The awards also obtained in the Pan-Pacific International Exposition have now been prepared by the management, and are expected to arrive in Melbourne at an early date.

COTTON GROWING IN AUSTRALIA.

A very large area in the northern parts of Australia has a climate suitable for the growth of cotton; indeed, it has been estimated by experts that this area is greater than that suitable for cotton in the United States, where, at the present time, two-thirds of the world's supply is produced.

That high-class cotton can be grown in Queensland was conclusively proved at the time of the American Civil War, when, owing to the inducement offered by the high price of cotton, that State exported 26 million pounds of ginned cotton, worth £1,300,000. The industry was subsequently almost abandoned, but partially recovered on the establishment of a cotton mill at Ipswich, which, however, eventually had to close down.

Authorities in Queensland consider that the best way to overcome the labour difficulty is to encourage farmers to grow small crops, say, 10 acres, of cotton, in addition to their other crops. It is calculated that a family of four persons could easily pick the cotton produced on this area without extra help.

It has also been suggested that if the Government intend to provide ready-made farms for settlers in Queensland after the war, cotton would be the best crop with which to start. It is estimated that a ready-made farm, comprising 80 acres of land, with a substantial bungalow-house, &c., would cost for clearing, fencing, planting crop, and erecting house, from £125 to £250, according to the nature of the vegetation on the land to be cleared.

Cotton waste, a by-product of the spinning mills, is one of the chief raw materials used in the present manufacture of cordite. As the result of an article by Mr. G. S. Hart, entitled "No Cotton, No Shells," published in the *Rockhampton Daily Record*, a meeting was held at Mt. Morgan, presided over by the mayor. This meeting resolved:—

> "That a Munitions Cotton League be now formed, to press forward the production of cotton in Australia, so that it may be available for the manufacture of munitions."

The meeting was widely advertised in Queensland papers, and the Department of Agriculture undertook to deliver free seed to the nearest railway station. The Queensland Government also guaranteed to purchase seed cotton at 1¾d. per lb. About 300 growers obtained seed, and about 800 acres were planted. Unfortunately, the season was unfavorable, and some of the seed available was not of very good quality, nevertheless, a considerable number of the crops gave high yields. The Queensland Department of Agriculture is importing enough of the best American cotton seed to plant an additional 1,000 acres next season.

Though the annual peace time requirement of prepared cotton waste for the manufacture of cordite in Australia is only 60 tons, yet it is obviously of great importance that Australia should be self-contained in the matter of the production of munitions. In England the cotton waste is specially treated in Government works and is supplied as a product of exceeding uniformity. Before Australian-grown cotton could be used for the manufacture of service cordite it would have to undergo

.. ilar treatment, and the cordite produced would require to be submitted .. exhaustive tests, both in respect to its stability and its ballistics. .. bility tests to be satisfactory would extend over a number of years.

Arrangements are now being made for the experimental manufacture .. a fairly large sample of cordite from Australian cotton. This will then be tested, and it is hoped that the results will be satisfactory. The arrangements for testing have been made by the Commonwealth Advisory Council of Science and Industry.

As already mentioned, the absence of experienced cotton-pickers in Australia has been one of the causes hindering the development of the industry. The patriotic action of the Munitions Cotton League has had the effect of familiarizing a considerable number of agriculturists in Queensland with the cultivation and picking of cotton.

The introduction of a mechanical cotton-picker is the most hopeful method of overcoming the difficulty due to the high cost of labour. Many machines for this purpose have been patented, but none has come into use, in spite of the fact that the invention of a simple contrivance which would enable the cotton to be picked twice as fast would make a fortune for its inventor. It is stated that the United States Department of Agriculture has spent £50,000 in experimenting with cotton-picking machines, and one American firm spent £5,000, and at last gave up experimenting. Several machines have also been invented in Australia.

The American inventors have mostly produced machines which pick the cotton by means of a number of arms bearing spikes which pass over the plant. These, however, damage the plant and spoil much of the cotton which is not yet ripe, and unless a variety of cotton could be produced which ripened all its seed at once, they are not likely to prove satisfactory.

The machines invented in Australia are on the suction principle, familiar in the vacuum-cleaner, and to allow them to achieve their best effect it would be necessary to grow a variety of cotton in which the valves of the cotton-bolls open wide so as to expose the cotton fully.

Australia is fortunate in that the only two cotton-pests at present established in this country are rust and the boll-worm, a species of cut-worm. The cotton-worm, cotton stainer, and dreaded boll-weevil of the United States are unknown, and it is important that imported seed and raw cotton should undergo rigid inspection to prevent the chance introduction of these pests.

In a recent issue of the Texas *Cotton and Cotton Oil News* it is stated: "If the boll-weevils destroy as much of this year's cotton as they did last year the remnant that escapes the weevil will not supply adequately the world's demand, even if the war should continue, and should the war cease this fall, the price of the staple would go sky-rocketing."

Though the latter result unfortunately does not now seem at all probable, enough has been said to show that the establishment of an Australian cotton industry is of great importance from the stand-point of national defence, and is likely to be profitable to the cotton-growers and also to be of considerable economic value to the Commonwealth, both by increasing the value of our production and by attracting population to the empty spaces of the north.

The possibility of establishing in Australia new industries dependent on the supplies of cotton for their raw material is also of obvious importance. The executive committee of the Commonwealth Advisory Council of Science and Industry is inquiring into the whole question of cotton-growing and the marketing and utilization of the raw cotton with a view to making a report on the whole matter to the Commonwealth Government.

—Communicated by the Commonwealth Advisory Council of Science and Industry.

PLANTING AND RECONSTITUTION OF VINEYARDS.

Conditions Governing the Distribution of Phylloxera-Resistant Vine Rootlings and Cuttings.

The conditions subject to which Victorian vine-growers may purchase phylloxera-resistant vine cuttings and rootlings (grafted or ungrafted) have been drawn up for the current year, and copies of same are now available on application.

Beyond the necessary alterations of dates (substitution of 1917 for 1916, &c.), the conditions are much the same as for last season. There is no alteration in price.

The time within which applications will be received has, however, been extended by one month in each case, as will be seen below. In view of this concession, applicants are required to finally decide, when filling in their application forms, as to their stock and scion requirements; no amendment can be permitted later.

A clause has also been inserted prohibiting any re-sale of resistant stocks supplied by the Department, without the written authority of the Director.

It will suffice here to explain that resistant vines are supplied to intending planters in any of the following forms, and at the prices stated, packing extra:—

Resistant rootlings, grafted with scions previously supplied by applicants, at per 1,000, £6.
Resistant rootlings, ungrafted, at per 1,000, £1 10s.
Resistant cuttings, at per 1,000, 15s.

Application Forms.

No application will be entertained unless made on the forms supplied for the purpose, which are obtainable from the Director, Department of Agriculture, Melbourne, or from the Principal, Viticultural College, Rutherglen.

Separate forms are provided for (*a*) Grafted Rootlings (yellow form), (*b*) Ungrafted Rootlings and Cuttings (pink form). Applications must be filled in on the proper forms.

Each applicant for forms will be supplied with a copy of the detailed conditions governing the distribution of phylloxera-resistant vine rootlings and cuttings.

Applicants are earnestly requested to thoroughly familiarize themselves with these. *They are warned that under no circumstances can any departure be permitted from the regulations governing the distribution as detailed therein, nor can any request for special consideration be entertained.*

DATES BEFORE WHICH APPLICATIONS MUST BE MADE.

For Grafted Rootlings (1918 distribution, June to August inclusive). Applications will be received until 30th June next. (For the 1917 distribution the time for receiving applications closed on 31st May, 1916, and present applicants cannot be supplied until 1918.)

For Ungrafted Rootlings and Cuttings, to be distributed from July to August inclusive, 1917, applications will be received until 31st July, 1917.

SUPPLYING CLEAN DISTRICTS.

Rootlings and Cuttings cannot be sent from nurseries in phylloxerated districts to clean districts. A limited number of clean Ungrafted Rootlings are, however, available for distribution to clean districts. The price charged is £2 per 1,000, packing extra. Applications for these will be received by the Principal, School of Horticulture, Burnley, until 1st June, 1917.

RUPESTRIS METALLICA (CAPE).

By F. de Castella, Government Viticulturist.

The phylloxera resistant vine stock known by the above name (the word "Cape" being used to distinguish it from a distinct variety of Vitis Rupestris, at one time rather largely used in France), has been fairly extensively planted in northern Victoria, and generally with satisfactory results. Until 1912 it was looked upon as a good stock, but during that year its value was rather seriously discounted by the decidedly adverse opinion concerning it which appeared in the preliminary report of the committee appointed by the Department of Agriculture of the South African Union to inquire into the suitability of American stocks.* The committee found that the stock in question could not stand much moisture in the soil, and that it suffered easily from drought. Though satisfactory in fairly deep, loose, cool soils that have never too much and never too little moisture, frequent failures were recorded in drier soils, it being even stated that the resistance to phylloxera was insufficient. The remarks concerning this stock concluded as follows:—"In most of the *Goudini* and similar soils, Metallica can be safely used, but in most soils it is a bad stock, and hence grafting on Metallica ought not to be continued in future."

* An extract from this report dealing with Rupestris Metallica (Cape) was reproduced in the *Victorian Agricultural Journal* for July, 1912.

Since the publication of the above, Metállica Cape has declined a good deal in public favour, especially in north-eastern Victoria. Nevertheless, our Victorian experience of this stock has been much less unsatisfactory than the above quotation would lead one to expect. Most of the vines grafted on it in Rutherglen vineyards have given satisfactory results for a good many years, only in a few cases on stiff soils liable to become hard and dry in summer can any inferiority be noted as compared with the other stocks in general use.

In the experimental plots at the Rutherglen Viticultural Station vines grafted on this stock have always yielded well; in some seasons even better than some of the standard stocks.*

At Mildura, more particularly, is this stock held in high repute by those who have had most experience with resistant stocks; the high opinion formed of it by those who employed it on irrigated land, is, in fact, directly responsible for the present note. Desiring to have more recent information concerning this stock, inquiries were made concerning its behaviour in South Africa, the country where it was first raised, and has been most extensively planted.

The following extract from a reply recently received from Mr. T. G Watermeyer, Manager of the Government Farm, Constantia, Wynberg, South Africa, will, no doubt, prove of interest to Victorian vine-growers.

Rupestris Metallica: Opinions upon the resistance of this stock appear to be divided. I shall express no opinion but give you all the facts I have about it. It originated on this estate. Several kinds of American resistant stock seeds were got out by the Department from France. After sowing selection fell on Metallica by the then Manager of this place. Mr. de Waal. After further propagation, vineyards were laid out on this estate on different situations, which comprised hill sides of red loams, also gravelly, clayey soils, low-lying, sandy loams, and pure loams.

The scions grafted on Metallica were Muscadels,† Cabernet. Hermitage. Riesling, Pedro Ximenes, and many other kinds, and on these different sites the vines have been growing now for sixteen years, and are still doing well, though it is necessary in the drier sites to fertilize every three years. In the alluvial soils we have in nine years given only two dressings of stable manure. On the whole in this district where there is an average rainfall of 40 to 60 inches. Metallica does well, and it does well mostly in deep, fairly moist, alluvial soils everywhere in the country.

Up country, in dry situations. it is being abandoned and being replaced by Aramon Rupestris 1 and 2. (A.R.G. 1 and A.R.G. 2.) Many viticulturists are so exceedingly careless when reconstituting, only ploughing to the depth of about 8 inches. In such cases failures are bound to result, and consequent condemnation of the stock, and it is sometimes difficult to know to what causes to attribute failure.

I notice that in this area many growers overtax the vine by allowing too many bearers on their bushed vines. I have counted as many as eight, which is just double what was allowed the European on its own roots.

The yields got from Metallica in some vineyards amount to as much as 889 gallons per acre, 5 feet by 5 feet, planting. but this is over taxation. Metallica seems to have most accommodating affinity, and carries most, in fact, all the different kinds of European varieties. With proper treatment and frequent manuring on this farm Metallica does well. It fails where it is badly treated and over taxed. It is, however, quite certain that it is not so good as a resisting stock as Aramon (A.R.G. 1).

* See Journals for May, 1909, 1910, 1911, and June, 1912.

† Muscadel is the name given to our Brown Muscat in South Africa.

METEOROLOGICAL OBSERVATIONS.

State Research Farm, Werribee.

G. S. Gordon, Field Officer, Werribee.

Summary of observations made during 1916, and comparison with previous years:—

Rainfall.

Average rainfall for forty-two years prior to 1913	=	20·19 inches
Rainfall during 1913 (505 points in March)	=	16·43 ,,
Rainfall during 1914 (304 points in December)	=	13·24 ,,
Rainfall during 1915	=	15·55 ,,
Rainfall during 1916 (4·46 inches in January and February, and 17·71 inches in September, October, November, and December)	=	28·79 ,,

Evaporation.

Evaporation from free water surface, 1913	=	46·438 inches
,, ,, ,, ,, 1914	=	50·548 ,,
,, ,, ,, ,, 1915	=	51·754 ,,
,, ,, ,, ,, 1916	=	43·160 ,,

Bright Sunlight.

Total bright sunlight during 1914 = 1,906·5 hours = Daily Mean, 5·2 hours.
,, ,, ,, 1915 = 1,865·9 ,, = ,, 5·1 ,,
,, ,, ,, 1916 = 1,841·8 ,, = ,, 5·0 ,,

Mean Air Temperatures.

Year.	Dry Bulb.	Wet Bulb.	Maximum.	Minimum.	Mean of Max. and Min.
1914	59·4° F.	55·8° F.	69·6° F.	48·6° F.	59·1° F.
1915	57·9° F.	53·8° F.	67·4° F.	47·8° F.	57·6° F.
1916	57·2° F.	53·4° F.	66·1° F.	47·7° F.	56·9° F.

Mean Soil Temperatures.

Year.	At 1 Inch.		At 6 Inches.		At 12 Inches.		At 24 Inches.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum	Minimum.
1914 .	70·9° F.	50·6° F.	63·6° F.	52·6° F.	61·6° F.	56·8° F.	60·2° F.	58·6° F.
1915 ..	72·1° F.	50·8° F.	63·2° F.	51·5° F.	60·8° F.	55·5° F.	59·9° F.	57·2° F.
1916 ..	70·2° F.	50·9° F.	61·4° F.	54·1° F.	59·2° F.	54·2° F.	58·5° F.	56·2° F.

Mean of Maximum and Minimum Soil Temperatures.

Year.	At 1 Inch.	At 6 Inches.	At 12 Inches.	At 24 Inches.
1914	60·7° F.	58·1° F.	59·2° F.	59·4° F.
1915	61·4° F.	57·3° F.	58·1° F.	58·5° F.
1916	60·5° F.	57·7° F.	56·7° F.	57·3° F.

STANDARD TEST COWS.

REPORT FOR QUARTER ENDING 31ST DECEMBER, 1916.

Thirty-two cows completed during the quarter.
Twenty-seven of these qualified.
Individual returns are as follow:—

F. CURNICK, Malvern. (Jersey.)

Completed during the quarter, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Peerless Pearl ..	3771	1.2.16	8.2.16	273	16	5,364	5·07	271·90	250	310

DEPARTMENT OF AGRICULTURE, Werribee. (Red Poll.)

Completed during the quarter, 13. Certificated, 11.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Cutty	Not yet allotted	4.1.16	11.1.16	273	12	6,059	4·73	286·77	175	327
Maria	"	*11.1.16	21.1.16	273	24	9,993	5·43	542·50	250	618½
Aridia	"	2.2.16	9.2.16	273	8	4,210	4·89	205·81	175	234½
Japana	"	11.2.16	18.2.16	273	23	7,997	3·42	273·39	250	311¾
Velveteen (imp.) ..	"	14.2.16	21.2.16	273	19	6,588	4·30	283·85	250	323½
Goldlace	"	28.2.16	6.3.16	273	25	6,642	4·51	299·29	175	341¼
Soudana	"	5.3.16	12.3.16	273	21	7,252	4·32	313·00	250	356¾
Canada	"	11.3.16	18.3.16	273	11	6,559	4·03	264·05	250	301
India	"	15.3.16	22.3.16	273	22	6,425	4·29	275·98	250	314½
Congo	"	20.3.16	27.3.16	273	16	7,142	4·19	299·66	250	341½
Barbery	"	23.3.16	30.3.16	273	5	6,541	3·99	261·17	200	297¾

* Calved two months prematurely.

GEELONG HARBOUR TRUST, Marshalltown. (Ayrshire.)

Completed during the quarter, 3. Certificated, Nil.

TREVOR HARVEY, Boisdale. (Jersey.)

Completed during the quarter, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Dainty ' I. ..	Not yet allotted	10.3.16	17.3.16	273	7½	5,985	5·57	333·25	200	380

A. W. JONES, Whittington. (Jersey.)

Completed during the quarter, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Lady Gray I. of St. Albans	Not yet allotted	20.3.16	27.3.16	273	18½	5.970	6·85	408·67	200	466
Lady Gray VIII. ..	"	25.3.16	1.4.16	273	21	8.667	4·99	432·26	250	492¼

C. G. KNIGHT, Cobram. (Jersey.)

Completed during the quarter, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Middlewood Larnpirr	2984	6.1.16	13.1.16	273	27	6.937	4·85	336·32	250	383¼

C. GORDON LYON, Heidelberg. (Jersey.)

Completed during the quarter, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
[illegible]	508	7.1.16	14.1.16	273	17	7,347	4·67	343·29	250	391¼

J. D. READ, Springhurst. (Jersey.)

Completed during the quarter, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Stockings ..	2663	18.3.16	25.3.16	273	12¼	6,363	5·03	320·15	250	365
Baron ..	1918	26.3.16	2.4.16	273	14½	6,476	5·77	373·78	250	426

MISS S. L. ROBINSON, Malvern. (Jersey.)

Completed during the quarter, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Twinkle	538 C.S.H.B.	14.2.16	21.2.16	273	29	7,247	4·65	336·96	250	384¼

W. WOODMASON, Malvern. (Jersey.)

Completed during the quarter, 7. Certificated, 7.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Peerless III. of Melrose	2817	28.12.15	4.1.16	273	15	7,341	5·26	386·15	250	440¼
Mystery XIII. of Melrose	3668	31.12.15	7.1.16	273	13½	6,148	6·48	398·23	250	454
Pleasance IV. of Melrose	1297	9.1.16	16.1.16	273	20	6,352	4·17	265·08	250	302¼
Jessie IX. of Melrose	3654	1.3.16	8.3.16	273	20½	6,961	5·32	370·18	250	422
Blossom IV. of Melrose	Not yet allotted	8.3.16	15.3.16	273	16	5,678	5·79	328·73	175	374¾
Mermaid II. of Melrose	"	11.3.16	18.3.16	273	19	6,607	4·74	313·50	250	357¼
Mystery IX. of Melrose	3665	23.3.16	30.3.16	273	11	5,080	5·85	297·08	250	338¾

C. FALKENBERG, Elliminyt. (Jersey.)

Completed during the quarter, 1. Certificated, 7.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Du[illegible] of Elliminyt	Not yet allotted	24.3.16	31.3.16	273	13	4,443	5·05	224·33	[illegible]	[illegible]

SIXTH VICTORIAN EGG-LAYING COMPETITION, 1916-1917.

Commenced 15th April, 1916; concluding 14th April, 1917.

CONDUCTED AT THE BURNLEY SCHOOL OF HORTICULTURE BY THE DEPARTMENT OF AGRICULTURE, VICTORIA.

LIGHT BREEDS.

WET MASH.

Six Birds. Pen No.	Owner.	Breeds.	15.4.16 to 14.1.17	15.1.17 to 14.2.17	Total to Date (Ten months).	Position in Competition.
1	G. McDonnell	White Leghorns ..	1,191	131	1.322	1
13	H. J. Meaddows ..	,, ..	1.182	123	1.305	2
3	W. M. Bayles	,, ..	1,155	135	1,290	3
36	E. W. Hippe	,, ..	1,168	109	1,277	4
41	Excelsior Poultry Farm ..	,, ..	1,137	126	1.263	5
28	S. Cheatle	R.C.B. Leghorns ..	1,118	133	1,251	6
37	J. M. Smith	White Leghorns ..	1,133	115	1,248	7
22	Mrs. H. Stevenson ..	,, ..	1,119	125	1.244	8
16	H. J. Duncan . ..	,, ..	1,132	108	1.240	9
40	A. Brundrett . ..	,, ..	1.113	114	1.227	10
38	V. Little	,, ..	1,098	111	1.209	11
44	J. Jamieson	,, ..	1,108	97	1,205	12
7	C. J. Jackson	,, ..	1,103	92	1.195	13
32	N. Burston	,, ..	1,062	129	1,191	14
8	L. A. Lawson	,, ..	1,049	138	1.187	15
17	W. G. Swift	,, ..	1.066	119	1.185	16
15	G. Laughlan	,, ..	1,084	97	1 181	17
29	A. S. Hyndman ..	,, ..	1.051	129	1,180	18
39	L. McLean	,, ..	1.039	133	1.172	19
43	S. Buscumb	,, ..	1.029	130	1,159	20
25	A. H. Mould	,, ..	1.063	94	1,157	21
11	R. W. Pope	,, ..	1.027	117	1.144	22
18	C. Ludwig	,, ..	1,027	115	1,142	23
10	T. Collings	,, ..	1,012	122	1,134	24
14	W. R. Hustler	,, ..	1,027	100	1,127	}25
23	I. A. Pettigrove ..	,, ..	1,015	112	1.127	
12	G. Hayman	,, (5 birds)	1,013	109	1,122	27
45	C. H. Oliver	,, (5 birds)	1 022	98	1 120	28
27	John Blacker	,, ..	1.018	94	1,112	29
6	J. J. West	,, ..	997	111	1,108	30
34	F. G. Silbereisen ..	,, ..	1.001	106	1.107	31
24	Mrs. H. N. H. Miranis ..	,, (5 birds)	997	103	1,100	32
101	A. E. Silbereisen ..	,, (5 birds)	960	107	1,067	33
19	Benwerren Egg Farm ..	,, ..	952	113	1.065	34
30	F. T. Dettner	,, ..	971	92	1.063	35
5	W. G. Osburne	,, ..	926	111	1.037	36
26	Mrs. A. Dumas	,, (4 birds)	934	88	1.022	37
35	Tom Fisher	,, ..	900	98	998	38
20	H. J. Merrick	,, ..	879	92	971	39
33	E. C. Evans	,, ..	851	119	970	40
4	Oakham Park	,, ..	858	109	967	41
31	J. H. Gill	,, ..	832	130	962	42
9	W. H. Clingin	,, ..	857	85	942	43
		Total ..	44,276	4.819	49,095	

HEAVY BREEDS.

DRY MASH.

Six Birds. Pen No.	Owner.	Breeds.	15.4.16 to 14.1.17	15.1.17 to 14.2.17	Total to Date (Ten months).	Position in Competition.
100	[illegible] Poultry Farm ..	Black Orpingtons ..	1.106	112	1.218	1
98	[illegible] Poultry Farm ..	,, ..	1.114	95	1.209	2
97	[illegible]	,, ..	1.068	82	1,150	3
91	[illegible] H. Coad	,, ..	916	67	983	4
96	[illegible]	,, ..	898	81	979	5
95	[illegible] W. Pearce ..	,, ..	881	55	936	6
99	[illegible]	,, ..	671	64	735	7
		Total ..	6,654	556	7,240	

SIXTH VICTORIAN EGG-LAYING COMPETITION, 1916–1917—*continued.*

LIGHT BREEDS.

DRY MASH.

Six Birds. Pen No.	Owner.	Breeds.	15.4.16 to 14.1.17	15.1.17 to 14.2.17	Total to Date (Ten months).	Position in Competition.
52	W. J. Thom	White Leghorns (5 birds)	1,286	108	1,394	1
53	W. N. O'Mullane	"	1,216	127	1,343	2
46	W. H. Robbins	"	1,233	97	1,330	3
54	Mrs. A. O. Hughes	"	1,156	127	1,283	4
59	T. A. Pettigrove	"	1,156	93	1,249	5
70	G. Wilkinson	"	1,139	109	1,248	6
47	H. McKenzie and Son	"	1,117	102	1,219	} 7
63	N. Burston	"	1,084	135	1,219	} 7
55	Rev. J. Mayo	"	1,088	112	1,200	} 9
69	E. A. Lawson	"	1,078	122	1,200	} 9
65	Izard and Tierney	"	1,069	107	1,176	11
67	Lysbeth Poultry Farm	"	1,044	117	1,161	12
60	A. Greenhalgh	" (5 birds)	1,034	116	1,150	13
58	C. Ludwig	"	1,032	98	1,130	14
62	J. W. Morrow	"	1,018	99	1,117	15
61	C. C. Dunn	"	997	103	1,100	16
56	Mrs. Nicoll	"	1,036	62	1,098	17
48	Thirkell and Smith	"	1,004	88	1,092	18
66	Benwerren Egg Farm	"	967	124	1,091	19
50	Clevedon Poultry Farm	"	934	90	1,024	20
51	Reliable Poultry Farm	"	924	84	1,008	21
64	A. Bennett	"	886	114	1,000	22
49	C. Lane	"	885	79	964	23
68	W. G. Osburne	"	824	95	919	24
		Total	25,207	2,508	27,715	

HEAVY BREEDS.

WET MASH.

Six Birds. Pen No.	Owner.	Breeds.	15.4.16 to 14.1.17	15.1.17 to 14.2.17	Total to Date (Ten months).	Position in Competition.
74	Oaklands Poultry Farm	Black Orpingtons	1,189	83	1,272	1
86	C. Ludwig	"	1,082	93	1,175	2
87	S. Buscomb	"	1,053	90	1,143	3
90	Excelsior Poultry Farm	"	1,050	91	1,141	4
80	Mrs. T. W. Pearce	"	1,043	96	1,139	5
91	N. Papayanni	"	997	108	1,105	6
83	L. McLean	" (5 birds)	995	95	1,090	7
92	J. H. Wright	"	994	75	1,069	8
85	Mrs. M. Coad	"	1,004	62	1,066	9
93	L. W. Parker	"	967	98	1,065	10
89	Brooklyn Poultry Farm	"	1,018	44	1,062	11
88	A. D. McLean	" (5 birds)	943	74	1,017	12
77	Mrs. G. R. Bald	"	908	98	1,006	13
81	K. Courtenay	White Plymouth Rocks (5 birds)	906	87	993	14
71	C. E. Graham	Faverolles	871	102	973	15
84	H. S. Trevana	Black Orpingtons	880	89	969	16
78	Reliable Poultry Farm	Rhode Island Reds	875	72	947	17
72	Marville Poultry Farm	Black Orpingtons (4 birds)	877	61	938	18
82	J. Ogden	" (5 birds)	787	105	892	19
76	L. A. Errey	"	779	92	871	20
75	Mrs. Drake	Silver Wyandottes	741	86	827	21
73	E. W. Hippe	Rhode Island Reds	668	30	698	22
		"				
		Total	20,627	1,831	22,458	

Report.

The weather conditions for the past month have not been favorable to egg production. Extreme heat was followed by cold south-east winds on more than one occasion, conditions which have had a bad effect on moulting hens, of which there are many at present.

Amongst the heavy breeds broodiness continues to be prevalent.

The health of the birds on the whole is good, and results are quite up to anticipations for this season.

Rain, 70 points. Temperature—Lowest, 44 deg. F.; highest, 104 deg. F. (in houses).

A. HART,
Chief Poultry Expert.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

Green Manures.

If a cover crop of leguminous plants is required for green manuring a start at planting may now be made. This can only be done when all the fruit has been gathered from the trees. An early crop is a distinct advantage. The cover crop should make a good growth before the winter sets in, as the plants make very little headway in the cold weather, and they require to be ploughed in as soon as the ground is dry enough in early spring. It will thus be seen that it is necessary to get a good autumn growth, as dense as possible, and one which will well cover the surface before winter.

Cultivation.

Should the weather become hot and dry it will be very necessary to give the land surface a good stirring, so as to conserve water supplies. Where fruit crops have been gathered a start may be made late in the month with the autumn ploughing; whatever ploughing is done should be left as rough as possible.

Pests.

No codlin moth-affected or diseased fruit of any kind should be left on the ground after the crop has been gathered. These should all be destroyed by boiling.

All rust-affected foliage and fruit of plum and peach trees, as well as all other stone fruits that have been attacked by this and other fungous diseases, such as shot-hole, &c., should be burned if possible. This will minimize the possibility of future attacks.

The Vegetable Garden.

Autumn weeds must be kept out of the kitchen garden. These rapidly grow, and remain as robbers right through until the spring time.

The section should be well dug over for planting winter crops. Before digging a light sprinkling of bonedust and a good top dressing of stable manure should be spread on the surface. These may then be dug in, as they provide humus for the soil. Large plots should be avoided in winter; where such occur a path should be run down the centre. This will provide more efficient drainage. The beds, too, may be more raised than in the summer time.

Early onions may be planted out in the beds, and, if not already done, onion seed should be planted at once.

All classes of seedlings may be planted out, and seeds of lettuce, early peas, beet, carrots, radish, cabbage, cauliflower, and swede turnip may be sown.

Asparagus beds should be cleaned up and cut down as soon as the berries begin to colour. Celery rows should be kept earthed up; rhubarb beds should be given a dressing of manure to encourage the coming winter crop, and new rhubarb plantations may now be established.

The Flower Garden.

All classes of spring-flowering bulbs may now be planted. In bulb planting the bulbs should not come in contact with any manure. The manure should, some time previously, have been dug well in, and mixed with the soil, and all heat should have disappeared. If manure is required it should be placed below the bulb, so that the roots may ultimately penetrate to it. Bulbs thrive in sandy soils, and where the soil is heavy a little sand may be added to advantage. Bulbs should not be planted too deeply; the depth to plant is generally regulated by the size of the bulb. Such bulbs as freesias may be covered with only an inch of soil, while larger bulbs may be somewhat deeper.

Dahlias and chrysanthemums may be fed with liquid manure, or mulched with stable or poultry manure. In any case the feeding should not be too strong nor too frequent, and it should always be withheld before the flowers come.

All hardy annual, biennial, and perennial seeds may now be planted. Among these are dianthus, candytuft, sweet peas, Iceland poppies, anemone, ranunculus, stock, wallflower, columbine, foxglove, phlox, penstemon, pansy, gaillardia, &c.

Wherever aphis and red spider occur the plants should be sprayed with benzole emulsion, nicotine, pestend, or soaperine, or some other preventive in order to protect the coming flowers. Mildew attacks on the rose should be warded off by the use of sulphur. The sulphur may be either dusted on the plant or it may be scattered on the ground around and under the plant.

March is one of the best months for transplanting evergreen plants of all classes, trees, shrubs, and palms. The roots of the transplanted plants should be disturbed as little as possible, while the roots of those transplanted from pots should be well uncoiled and set out before planting.

The soil is now warm, and the roots will quickly take hold and grow. They are thus established for the winter, and will give little or no trouble in the subsequent summer heat and dryness.

In preparing the soil for planting the trees care should be taken not to dig small holes. A small hole is simply a "pot hole," in which the winter water accumulates, and as a result the young tree roots are rotted.

A large hole should be dug; or better still, the whole planting area should be well cultivated all over, and the plants or trees then set out in this cultivated area.

REMINDERS FOR APRIL.

LIVE STOCK.

HORSES.—Those stabled should be fed liberally. Food of a more stimulating nature can now be given to get them well over the "changing coat" season. Those doing fast or heavy work should be clipped; if not wholly, then trace high. The legs should not be clipped. Those not rugged on coming into the stable at night sweating freely should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Yearling colts if vigorous and well grown may be castrated. Weaned foals should have a little crushed oats daily, if available. Horses to be turned out during winter should not be clipped. Their mouths and feet should be examined and attended to where necessary.

CATTLE.—As the nights become colder the dairy cows should be rugged. The rugs should be removed in day-time when the shade temperature reaches 60 degrees. If new grass is plentiful, give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. It will be found profitable to give a few pounds of bran, crushed oats or pollymeal in addition to other feed, to all cows giving a fair quantity of milk. Read article by Mr. B. A. Barr "Food Values and Rations," in *Journal* for September, 1916. Algerian oats should be sown on suitable land for grazing off in the winter. Sow a mixture of oats, rye, and tares or peas for winter fodder or to fill silos. Only exceptional cows or those required for city milk supply should be served between now and July. Within the next two or three months is the best time for cows to calve, as they will pay to feed through the winter, give the best returns for the season, and be dry when the feed is dry and at its worst. Calves should have lucerne hay or crushed oats when grass is not plentiful.

PIGS.—Sows not already served should be put to the boar. Supply all pigs with plenty of bedding, and see that sties are warm and well ventilated. Supply sows liberally with grain. Castrate young boars as early as possible. Pigs should be highly profitable now, as feed is cheap, and pork very dear.

SHEEP.—Merino and fine cross ewes, if they have been mated early, will lamb from now on. Those in lamb to the larger British breeds of rams will give a certain amount of trouble in lambing, and anticipating the extreme

value of meat and wool close attention should be given morning and evening to save every lamb possible, and any ewes that may be cast. If the ewes are well-woolled sorts, they will need crutching for fly, at the same time clear wool from around teats, and away from the eyes also. If the ewes are attentive mothers any lambs that are found dead after these precautions, apart from weather conditions, foxes, &c., are just as well gone. Give purgative drenches at first sight of ewes appearing ill in any way. Give warm salad oil to any lambs that are dull in appearance. Ewes after difficult parturition or retention of after-birth can often be saved by flushing out with ½ oz. Lysol to 3 pints warm water. Reserve fresh pasture, or better still, sow a mixed green crop to turn ewes into later on, but not while carrying the lambs, this is too often injurious. On fine mornings when attending ewes, if feed is plentiful and ewes strong castrate as many ram lambs as possible, they are easily caught when two or three days old. Place them between the feet on the ground, no holder is necessary. In districts where conditions make second dipping a necessity, see that it is done before the weather becomes too unsettled.

POULTRY.—Do not feed maize this month—soft food aids moult; add a teaspoonful of linseed to each bird's ration once daily. The more exercise the hens get the better they moult. Remove all male birds from pens. Add to drinking water one packet Epsom salts to twenty birds. Keep a sharp look out for chicken pox. Forward pullets should now be in their winter quarters, with plenty of scratching litter, and fed liberally—including ration of animal food. Grit shell and charcoal should always be available.

CULTIVATION.

FARM.—Dig potatoes as they mature. Cart out and spread stable manure. Finish preparation of land for main cereal crops. Sow Chou Moellier seed in beds for transplanting. Sow the following mixture per acre for green feed during the winter months for the dairy herd:—1½ bushels, Oats; ½ bushel, Cape Barley; ½ bushel, Tick Beans; ½ bushel, Vetches. Sow Giant Drumhead Cabbage for transplanting (1 lb. sufficient for 1 acre, in rows 3 feet apart); provided the soil is in good friable condition, plants from seed sown last month should be planted out. Sow wheat and oats according to locality: also rape for winter feed or green manuring. Prepare clean seed-bed for lucerne; and sow Hunter River, Arabian, or Peruvian seed, free from dodder, in drills 7 inches apart and at the rate of 12-16 lbs. of seed per acre. Sow permanent pastures with grasses and clovers.

ORCHARD.—Prepare land for planting; plough deeply and sub-soil. Plant legumes for green manure. Plant out strawberries. Clean up Codlin Moth from trees as soon as all fruit is gathered.

FLOWER GARDEN.—Plant out evergreen shrubs, trees, and Australian plants, divisions of herbaceous plants, seedlings, layers, and rooted cuttings. Feed chrysanthemums with liquid manure weekly until flowers begin to open. Prepare land for future plantings of roses and shrubs.

VEGETABLE GARDEN.—Plant out seedlings from the seed beds. Dig all vacant spaces roughly. Sow onions for early crop; also peas and broad beans. Clean out asparagus beds wherever the seeds are ripening.

VINEYARD.—Consideration must be given to manuring; early application is strongly urged. Peas, &c., for green manuring should be sown as soon as possible.

Cellars.—Cleanliness is emphatically urged. Carefully remove all fermentable refuse—skins, lees, skimmings, &c. Such odds and ends favour multiplication of Vinegar Flies (*Drosophila funebris*). If present destroy these with formalin or insecticide powders. A little bisulphite or sulphurous acid in washing water is recommended; also free use of lime on floors, &c.

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SPECIAL ISSUE

Urging the utilization of the Power of the Primary Producer to help to Win the War by supplying the staple foodstuffs called for by the Leaders of the Empire.

The appeal to farmers and land-holders, which runs through the whole of the articles, comes from England—our England; it comes from the hearts of the millions who are making the supreme sacrifice; it is made articulate by the clarion voice of the British Prime Minister, the Right Hon. Lloyd George, and re-echoed in this outpost of Empire by our own Prime Minister's stirring words, with which we are privileged to open this issue.

3181

COMMONWEALTH OF AUSTRALIA.

TO THE FARMERS OF AUSTRALIA

The citizens of this fair country stand and watch the progress of this mighty war as a crowd watching a fire afar off. Many of their number, hearing the faint cry for help, have plunged into the maelstrom of death to succour human life; the conflagration, notwithstanding that sacrifice, has increased in vigor until to-day, eddying and swirling with blinding fury, it threatens to engulf the whole world.

Engrossed with the fighting, and reeling under the shock of battle, the people of the allied nations cannot maintain their food supplies without the assistance of the Dominions.

Upon an ample supply of food all depends. If Germany falls, she will fall because she can no longer feed her people. Though her legions stand like a granite wall against the furious onslaughts of the Allies, yet their valor will avail nothing unless the 120 million people in the Central Empires can be fed. And what is true of Germany is no less true of Britain. Unless her 45 millions are fed from overseas nothing can save her; although she pile munitions mountain high, though the roar of her great guns burst the heavens, though the fury of her attacks tear large gaps in the ranks of the enemy, unless the 45 millions in Britain are fed, victory will glide from her nerveless hand.

Australia's duty in this great crisis is obvious; we must make available in increasing quantities the products necessary to enable the Empire and its Allies to win the War. I appeal to you, the primary producers, therefore, to stand behind your fellows in Europe, and leave no stone unturned to see that their pressing food requirements are forthcoming.

Upon your answer hangs our destiny, and that of the civilized world.

W M Hughes

PRIME MINISTER OF AUSTRALIA.

FOOD PROBLEMS OF THE WORLD.

Hon. F. W. Hagelthorn, M.L.C., Minister for Agriculture.

At no time in the history of the world has there been greater anxiety in regard to the food supply than now. In belligerent countries the making of munitions, the building of ships, and the actual fighting on land and sea have removed more men from their ordinary vocations, and particularly from agricultural production, than at any other time in the world's history. Neutral nations are but little better off in this regard. Large profits and high wages have depleted the agricultural districts of their manhood in most of the large food-producing countries.

Mr. William Robinson, of London, who is well known in Australia and throughout the Empire as a very capable business man, writes to say, "The greatest question facing the civilized world to-day is food supplies. At the outbreak of war the food problem was attracting attention, and most competent experts considered the position dangerous. To-day no man who studies the position can regard the outlook other than one of the utmost gravity, threatening upheavals the extent and effect of which no man can foresee."

Austria is on the verge of starvation; her allies are but little better off. France and England, and all neutrals are, we know, having considerable difficulty in regard to food supplies generally. The cables inform us that strict rationing has for some time been in operation in enemy countries, and has partially begun in Allied countries.

Mr. Robinson further says:—"In North and South America, as in all other neutral countries, the call for men, for metals, shells, ships, chemicals, and every other munition, backed by big wages and big profits, has drained the agricultural districts, and production has on one hand suffered, and consumption, by reason of high wages, has increased. We have to grow every ounce of food we can. Every ounce Australia can spare will be required, even though it may have to be temporarily stored. The wheat crop of Australia, Canada, India, and the Home country must be retained under State control, and used for the benefit of the Empire first, and the Allies next. The same with meat and other foods—not merely for one year, but for a series of years. The wheat pool, or some adaptation of it, is going to live a long time. We are in for a period of collective trading, if not actual trading, between Governments in many of the staple products of life. We will certainly have to see a rapid and complete change from our war policy of stimulating the production of all metals everywhere, and replace it with a policy of stimulating the production of all food everywhere. Never was there a greater call throughout the Empire for organization and efficiency than now."

To-day there is a world shortage of food. The 1916 crop of the Northern Hemisphere showed a tremendous falling off as compared with 1915. The shortage in the six staple foodstuffs—wheat, oats, maize, barley, rye, and potatoes—for man and beast, amounted to no less than 2,200,000,000 bushels. The falling off in the wheat production last year was over 800,000,000 bushels, as compared with the 1915 crop.

If this represented the total shortage, the position would be serious enough. We know, however, that immense quantities of food have been destroyed on land, or have been sunk at sea.

In the recent Rumanian campaign, millions of bushels of wheat, oats, barley, and other foodstuffs, representing the 1916 crop, and the surplus of the two previous crops, were destroyed to prevent the food falling into German hands.

At sea hundreds of thousands of tons of shipping have been sent to the bottom every month. A large portion of the tonnage represented foodstuffs destined for European nations.

The falling off in production has been due to two things:—

(*a*) A diminished acreage in Allied and neutral nations.

(*b*) A bad season for the Northern Hemisphere.

When we turn to the other great staple food—meat, which includes fats—the position is no better. The Central Empires have been compelled, in order to preserve their grain for human food, to slaughter enormous numbers of cattle, sheep, and pigs, and that applies to a lesser extent, perhaps, to the Allied countries.

Not only during the continuance of the war, but in all probability for several years after hostilities have ceased, the flocks and herds cannot be materially increased, and it will take some time for agricultural activities to be restored to normal conditions.

Another important factor that is likely to reduce the world's supply of food is the insufficient supply of artificial manures, which are absolutely essential to heavy crop production. This is particularly true of nitrates for Germany and her Allies, and potash for Allied and neutral countries.

Australia has been able to help in sending her troops to fight shoulder to shoulder with the troops of Britain. We have taken our share of the financial responsibilities of the Empire, and now the call comes for those of us who remain behind in security to do all we can to provide the most abundant supply of foodstuffs.

The position in which the Empire and her Allies are placed must give us in Australia very grave concern, and must compel us to ask ourselves the question: How far can we help to supply the Empire's needs?

The help we have given the Empire in providing men has been appreciated by the Mother Country as of the utmost importance, but in all probability the growing of foodstuffs during the time referred to will be of even greater importance than the supplying of troops. The Empire's requirements in this regard gives Australian producers a great opportunity for highly profitable agricultural expansion.

In regard to wheat, this season and its predecessor, have seen Australia secure two record crops, despite the considerable difficulties with which the Australian farmers have had to contend.

When we consider the question of live stock, the position is much less satisfactory. While Germany, the Argentine, and many other countries have enormously increased the number of their live stock during the last twenty years, that of Australia has not only not increased, but to-day the number is considerably less than twenty years ago. We find that in 1894 we had twelve and a quarter million cattle, and one hundred and six and a quarter million of sheep, while just prior to the last drought we had 11,000,000 cattle and 82,000,000 sheep, and the number to-day, both of cattle and sheep, is much less than in 1914.

We are not only called upon then to increase our production of wheat, but to take the most effective steps to increase the number of our flocks and herds.

In this huge continent of Australia, much of it so eminently suited for the breeding of cattle, we find that the number to-day is lower than that of the British Isles. We have about 10,000,000—they have upwards of 12,000,000.

Two important factors that will enable us to increase the stock-carrying capacity of Australia are the conservation of water, and the conservation of fodder. When it is remembered that both sheep and cattle are to-day worth nearly three times their ordinary value it goes without saying that over large parts of the Continent it will pay handsomely to conserve both water and fodder.

Even with the utmost efforts we can make, it will be impossible to rapidly increase the number of our sheep, and it will take still longer to materially increase the number of cattle. However, while this increase is proceeding, much can be done in rapidly increasing the supply of both pigs and poultry.

In the limited space allowed for an article, it is not possible to indicate the steps which might be taken to increase, at once, the food supplies produced in Australia. Some of the means are obvious, and are already being put into operation; others require the careful consideration of the most expert men we have available. But speaking generally, it might be said that the amount of meat consumed in Australia might be considerably reduced, and the reduction would, according to the best medical opinion, be a distinct advantage, both from a dietetic standpoint, as well as from the point of view of public health. A lessened consumption of 20 per cent. would mean much to the more rapid increase of our flocks and herds. The partial substitution of pork and poultry for beef and mutton would be another factor.

The consumption of meat per head of population in Australia is 225 lbs., as compared with 100 lbs. for Germany and Great Britain. If we could reduce this consumption by 15 per cent., and by a further 15 per cent. by the substitution of pork and poultry for mutton and beef, the saving would be enormous.

Assuming eight sheep to be equal to one head of cattle, it would mean that an equivalent of 6,000,000 sheep would be saved from home consumption. But it may be safely predicted that, with proper organization, the supply of food-stuffs, now so urgently required throughout the world, can be materially increased in Australia. We have the land, the climate, and our people have the necessary energy and experience to help Australia and the Empire in this direction.

The financial needs of Australia demand that agricultural production shall be brought to its fullest fruition, and we can best serve Australia and the Empire by bending our whole energies as a people to accomplish this work.

It must be abundantly evident to all thoughtful people in Australia that our material prosperity almost entirely rests on the success of primary production. This foundation, when satisfactorily and permanently laid, will enable the superstructure of a permanently prosperous and progressive State to be built.

THE GERMAN CHALLENGE TO BRITISH AGRICULTURE.

What will be the Response?

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

German agriculture has made extraordinary progress during the past 25 years, the net result of which has been to make the German Empire nearly self-supporting as regards food supplies during the present war.

Had it not been for the enormous increase in agricultural production, which was a natural development of the economic policy of the country and the organization of its agricultural forces, the German Empire would have exhausted its food resources long before the end of the second year of the war, and would have been compelled to sue for peace.

Germany has brought all the resources of science and organization to bear on her agricultural problems, and on an area two and a half times the size of Victoria, or two-thirds the size of New South Wales, has succeeded in feeding a population of 68,000,000. Germany's agricultural development has been so remarkable that we would do well to examine it, endeavour to determine the factors responsible for it, and see whether organized British effort cannot surpass it.

I.—THE RENAISSANCE OF GERMAN AGRICULTURE.

It is generally supposed that the British farmer is unexcelled in his craft, and that British farming is the best in the world. If we judge the success of a system of farming by its capacity to produce high average yields of all classes of crops, and produce the best types of live-stock, it must be admitted that the British farmer holds a high rank among the farmers of the world. But if we judge British farming on the basis of the aggregate volume of output per unit of area, it must be confessed that it compares unfavorably with that of Germany.

In an excellent article on "The recent development of German Agriculture," T. H. Middleton, Assistant Secretary of the British Board of Agriculture, brings out this point very strikingly. He shows that on each 100 acres of cultivated land—

"(1) The British farmer feeds 45 to 50 persons, whilst the German farmer feeds from 70 to 75 persons.

(2) The British farmer grows 15 tons of corn, whilst the German farmer grows 33 tons.

(3) The British farmer grows 11 tons of potatoes whilst the German farmer grows 55 tons.

(4) The British farmer produces 4 tons of meat whilst the German farmer produces $4\frac{1}{4}$ tons.

(5) The British farmer produces $17\frac{1}{2}$ tons of milk, the German farmer 28 tons.

(6) The British farmer produces a negligible quantity of sugar, whilst tho German farmer produces $2\frac{3}{4}$ tons."

This is a most striking method of comparing the results achieved by British and German farmers. The success of the German farmer seems so astonishing and incredible that one naturally asks for further details. These will be gradually unfolded, and it would be well to ponder over them deeply so that the lessons they convey may sink in.

Crop Production.

First let us compare the agricultural production of Germany and Great Britain in 1888 and 1913, and find what changes have taken place during the twenty-five years.

Consider first the crop products. Table I. shows the production of cereals and potatoes in Great Britain and Germany in 1888 and 1913.

TABLE I.

Showing production of cereals and potatoes in Great Britain and Germany in 1888 and 1913.*

—	Wheat.	Oats.	Barley.	Rye.	Potatoes.
	Millions of Bushels.				
Great Britain in 1888 ..	76	151	70	14	228
Great Britain in 1913 ..	58	180	68	2	283
Increase or Decrease ..	−18	−19	−2	−12	+55
Germany in 1888 ..	103	243	97	262	950
Germany in 1913 ..	171	669	168	481	1,988
Increase or Decrease ..	+68	+426	+71	+219	+1,038

* Abstracted from the Year Book of the United States Department of Agriculture 1915.

This table shows conclusively that while the volume of production in Great Britain has remained stationary, that of Germany has nearly doubled. The total increase in the four cereal crops—wheat, oats, barley, rye—in twenty-five years in Germany is more than double the whole of Britain's production of these cereals, whilst the increase in the potato yield of Germany in twenty-five years is four times the whole potato production of Great Britain.

Live Stock Production.

But it may be objected that the British farmer has confined his attention to stock raising rather than the growing of cereal and root crops, and that in this sphere at least Great Britain has kept pace with Germany.

Let us therefore examine the figures showing the numbers of live stock kept in Great Britain and Germany during the period under review. These are set out in Table II.

GRAPHICAL REPRESENTATION OF COMPARATIVE PROGRESS IN AGRICULTURAL PRODUCTION DURING PAST TWENTY-FIVE YEARS IN GREAT BRITAIN AND GERMANY.

I. GREAT BRITAIN.

1888. 1913.

Decrease, 24 per cent.

Wheat, 76,000,000 bushels. Wheat, 58,000,000 bushels.

Increase, 12 per cent.

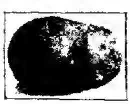
Oats, 151,000,000 bushels. Oats, 180,000,000 bushels.

Decrease, 6 per cent.

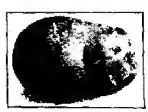
Barley, 70,000,000 bushels. Barley, 68,000,000 bushels.

Decrease, 86 per cent.

Rye, 14,000,000 bushels. Rye, 2,000,000 bushels.



Increase, 20 per cent.



Potatoes, 228,000,000 bushels. Potatoes, 283,000,000 bushels.

II. GERMANY.

1888. **1913.**

Increase, 66 per cent

Wheat, 103,000,000 bushels.

Wheat, 171,000,000 bushels.

Increase, 175 per cent.

Oats, 243,000,000 bushels.

Oats, 669,000,000 bushels.

Increase, 73 per cent.

Barley, 97,000,000 bushels.

Barley, 168,000,000 bushels.

Increase, 84 per cent.

Rye, 262,000,000 bushels

Rye, 481,000,000 bushels.

Potatoes, 950,000,000 bushels.

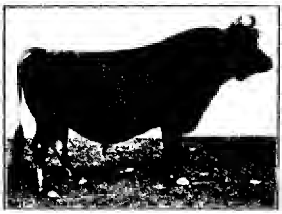
Potatoes, 1,988,000,000 bushels.

Increase, 109 per cent.

GRAPHICAL REPRESENTATION OF COMPARATIVE PROGRESS IN ANIMAL HUSBANDRY DURING PAST TWENTY-FIVE YEARS IN GREAT BRITAIN AND GERMANY.

I. GREAT BRITAIN.

1888. **1913.**



Cattle, 10,270,000.

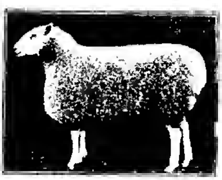
Cattle, 11,914,000.

Increase, 16 per cent.

Horses, 1,940,000.

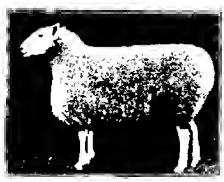
Increase, 3 per cent.

Horses, 1,999,000.



Sheep, 28,940,000.

No Increase.



Sheep, 28,967,000.

Pigs, 3,820,000.

Increase, 6 per cent.

Pigs, 4,055,000.

II. GERMANY.

1913.

Cattle, 20,182,000.

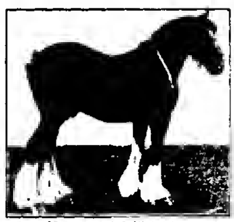
1888.

Cattle, 8,740,000.

Increase, 131 per cent.

Horses 2,420,000.

Increase, 87 per cent.



Horses, 4,523,000.

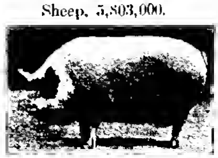
Sheep. 14,750,000.

Decrease, 30 per cent.

Sheep. 5,803,000.

Pigs, 5,820,000.

Increase, 279 per cent.



Pigs, 22,100,000.

Table II.

Showing number of live stock in Great Britain and Germany in 1888 and 1913.*

—	Horses.	Cattle.	Pigs.	Sheep.
	(In thousands.)			
Great Britain in 1888	1,940	10,270	3,820	28,940
Great Britain in 1913	1,999	11,914	4,055	28,967
Increase or Decrease	+59	+1,644	+235	+27
Germany in 1888	2,420	8,740	5,820	14,750
Germany in 1913	4,523	20,182	22,100	5,803
Increase or Decrease	+2,103	+11,442	+16,286	−8,947

* Year Book of the United States Department of Agriculture 1915.

These figures must surely be regarded as a remarkable achievement for German agriculture. In addition to increasing the wheat yield by 68 million bushels, the oat yield by 426 million bushels, barley by 71 millions, rye by 219 millions, and potatoes by 1,038 million bushels. Germany has enormously increased the stock-carrying capacity of the country. We may best compare the relative stock-carrying capacity of the two countries by reducing the cattle and horses to the equivalent of sheep.

Assuming a horse or a cow to be equivalent to eight sheep in grazing requirements, and that a pig is equivalent to a sheep, we find that in twenty-five years Great Britain's stock-carrying capacity has been increased by the equivalent of 14 million sheep, whilst Germany, during the same period, has increased her stock by the equivalent of 114 million sheep. The value of the increase in twenty-five years is equal to the value of the whole of the live stock in Great Britain.

Increase in Efficiency.

These figures show the remarkable development in German agriculture, both in the realm of crop production and live-stock farming. It may be added that these developments have been brought about without any material increase either in the acreage under crop, or in the number of persons engaged in agricultural pursuits. It is due, indeed, almost solely to the increased efficiency of German farming, due to the introduction of improved technical methods and the systematic organization of the agricultural forces of the country.

That increased efficiency is the keynote of Germany's progress is obvious from a consideration of Table III., which summarizes the average yield of corn, hay, and potatoes in Britain and Germany for five-year periods.

TABLE III.

Comparison of average yield per acre of corn, potatoes, and hay in England and Wales and Germany, over a period of 25 years.

—	Yield per acre per annum.			
	England and Wales.		Germany.	
	1885-89.	1909-13.	1883-87.	1909-13.
Wheat (bush.)	29.5	31.2	19.8	31.6
Barley „	32.4	32.7	22.7	36.7
Oats „	38.8	39.0	25.7	44.6
Meadow Hay (cwt.)	26.1	23.1	22.5	33.7
Potatoes (tons)	5.9	6.2	3.4	5.4

It will be seen that England has increased her average wheat yield in 25 years by 1.7 bushels, barley yield by .3 bushel, oats by .2 bushel, and potatoes by .3 ton per acre. The yield of meadow hay declined by 3 cwt. per acre. That is to say, the yields over a 25-year period are practically stationary.

On the other hand, Germany has increased her average wheat yield by 11.8 bushels, barley by 14 bushels, oats by 18.9 bushels, potatoes by 2 tons per acre, and meadow hay by 11.2 cwt. An average increase of nearly 60 per cent. in yield per acre.

Of course one might be inclined to argue that 25 years ago the average yield per acre of Germany was so low that it was capable of great improvement, whereas British yields have always been kept at a high standard, and further profitable increases were not possible on account of the law of diminishing returns. This may be so, but it is more probable that the yields obtained in Germany 25 years ago were the maximum yields possible under the agricultural methods then practised, and that the phenomenal increases are due to improved methods of tillage.

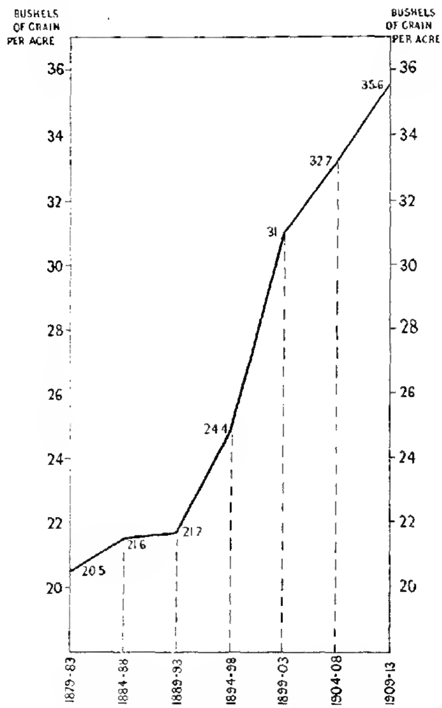
This much seems certain. the soils of Germany are not as fertile, nor is the climate so suitable for the production of heavy yields of cereals, roots, and hay, as those of Great Britain. English agricultural writers generally assume, and German writers tacitly admit, that the soils and climate of Great Britain are superior to those of Germany.

That the increase in production is accounted for by increased efficiency of the farmers may best be seen by comparing the average yields over a series of five-year periods. When the averages are taken over quinquennial periods the effect of variations in the seasons is eliminated, and the gradual improvement in yield is thrown into relief.

In the first graph are summarized the composite average yields of wheat, barley, oats, and rye in five-year periods for the past 35 years. The average yields have been calculated in bushels of 50 lbs., representing the average weight of a bushel of oats, barley, and wheat.

This graph brings out in striking fashion the steady and continuous improvement in efficiency in the culture of cereal crops. For fifteen

years, namely, 1879 to 1893, the yield per acre remained practically stationary and only increased by 1.2 bushels. During the last twenty years, however, the yield jumped from 24.4 bushels to 35.6 bushels per acre, an increase of 11.2 bushels, or approximately ten times the average increase for the first fifteen years. Similarly with regard to the potato yields (page 208) during the first fifteen years of the period the average yield per acre increased from 3.05 to 3.48 tons. During the last twenty years the yield increased from 3.48 to 5.46 tons per acre—an increase of 1.96 tons, or a percentage increase of 58 per cent.



GRAPH SHOWING COMPOSITE AVERAGE YIELD PER ACRE OF WHEAT BARLEY OATS & RYE IN GERMANY IN QUINQUENNIAL PERIODS FOR PAST 35 YEARS

The graphs show the increases in yield of various crops per acre. Another interesting example of the technical improvements effected in German agriculture is afforded by considering the improvements made in the quality of the crops. Take, as an example, sugar beet. In the days of Napoleon, who established the beet industry, the beet root contained only 7 per cent. of sugar. By continuous selection the sugar content of beets has been raised to at least 18 per cent. of sugar.

In 1876 it was necessary to treat 11.62 tons of beet roots to obtain 1 ton of sugar; at the present time the sugar content of the beets has improved to such an extent that less than 6 tons of beets will give a ton of sugar.

The following table illustrates this point forcibly:—

TABLE IV.

Showing total weight of sugar produced in Germany, and weight of beet necessary to produce 1 ton of sugar for consecutive quinquennial periods.

Year.	Total Sugar Produced.	Weight of Beet necessary to produce 1 ton of Sugar.
	Tons.	Tons.
1875	..	11·62
1887	1,098,000	8·16
1888–1892	1,149,000	7·77
1893–1897	1,576,000	7·67
1898–1902	1,928,000	7·01
1903–1907	1,992,000	6·41
1908–1912	2,068,000	6·07

Again we see that the most striking advances, both in total production of sugar and in the quality of the roots has taken place during the past twenty-five years.

The progress recently made in the improvement of the sugar content of beets may be illustrated by the graph on page 213. In the early days of the industry, sugar beet contained about 7 per cent. of sugar. The method of selection practised at first was to choose medium-size beets of good shape and immerse them in a solution of brine of a given concentration and rejecting all beets that floated in this solution. By these methods the sugar content was raised in thirty years from 8.8 to 10.1 per cent. From 1868 the polarimeter was used to estimate the sugar content of the beet, and exact chemical control replaced empirical methods of selection. In twenty years the sugar content was raised from 10.1 to 13.7 per cent. Finally, it was discovered that beets varied considerably in their power of transmitting sugar content to their progeny, and a system of selecting came into vogue whereby hereditary powers of all high testing "mother plants" were determined before seed from such plants was used.

This combination of physical selection (for shape and size) chemical selection (for sugar content) and physiological selection (for hereditary power of high-grade plants) enabled the average sugar content of beets to be raised from 13.7 per cent. to 18.5 per cent. in 24 years. As individual sugar beets frequently contain up to 26 per cent. of sugar, it will be seen that the possibilities of further improvement by selection are by no means exhausted.

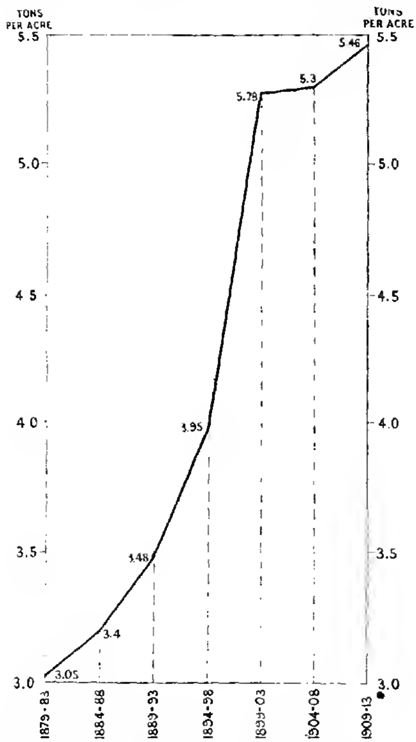
It would appear from a consideration of these graphs and tables that the awakening of German agriculture is a feature of the past fifteen to twenty years. It really synchronises with the adoption of a settled economic policy, the systematic organization of agricultural

education, and the widespread diffusion of technical agricultural knowledge among the German agrarian class.

Man-carrying Power Compared.

Before considering these developments, let us consider one final proof of the efficiency of German agriculture. The ultimate criterion of the efficiency of a nation's agriculture is the population it can support on a unit area. In 1888 the population of Germany was estimated at 48,000,000. In 1913 the population had increased to 67,000,000. In spite of this enormous increase there was no falling off in the percentage of foodstuffs raised within the Empire.

From 1910 to 1913, 97 per cent of the oats, 100 per cent. of the rye, 98.6 per cent. of the potatoes used in Germany were produced



GRAPH SHOWING AVERAGE YIELD PER ACRE OF POTATOES IN GERMANY. IN QUINQUENNIAL PERIODS FOR PAST 35 YEARS

within the Empire. Only in wheat was her production short of home requirements—68 per cent. of the total required being produced at home.

The German farmer has been able to feed 70 to 75 persons for each 100 acres of cultivated land, whilst the British farmer has only been able to feed 45 to 50 persons on the same area.

We have shown the increases in German agricultural production in terms of man-carrying capacity. Let us finally consider the cash value of the increased production.

Whilst British crop production has actually declined during the past 25 years, that of Germany has increased by £120,000,000 sterling.

Again, in 1914, the live stock of Germany was valued at £690,000,000, an increase of £340,000,000 since the 1892 census. The value of the live stock of Great Britain, calculated on the same price basis, was, in 1914, £350,000,000. That is to say, the increase in live stock in Germany for 22 years was equal to the value of the whole of the live stock of Great Britain.

Von Schwerin Lowitz,* estimates that the annual value of Germany's agricultural produce approximates £700,000,000, made up principally of corn £140,000,000, meat £200,000,000, milk £137,500,000, potatoes and sugar beet £80,000,000, the balance being made up of fruit, vegetables, oil, and fibre crops, viticulture, and poultry products.

According to Steinmann-Bucher, "the gross value of goods manufactured in Germany in 1905 was £1,800,000,000. The net value of these manufactured goods, i.e., the value of the finished goods, without counting articles two or three times over in various stages of manufacture, would not exceed £700,000,000." Considered therefore from the point of view of the value of the produce, German agriculture has been able to maintain a position of equal importance with that of the tremendously increased manufacturing industries.

II.—FACTORS UNDERLYING GERMANY'S AGRICULTURAL RENAISSANCE.

Apart from her economic policy, which has been systematically directed to produce sufficient foodstuffs within her own territory to feed her rapidly increasing population, Germany's progress may be attributed to—

(1) The systematic organization of agricultural education.
(2) The improvement effected in the technical methods of the farming community.
(3) The widespread adoption of co-operation and organized credit.

In a calm and passionless review of *Germany's Food supply: Can it Last*, Professor Eltzbacher's Committee of Scientists concluded as follows:—

"We shall hold out. That we can do so is thanks to our agriculture. In the last ten years, under the powerful protection of Governments whose clear foresight recognised the danger of Germany developing into a one-sided industrial country, and through the vigorous action of distinguished men, agriculture has made a tremendous advance, both to its own profit and with the gratifying result that we are able in case of need to feed 68,000,000 people on a territory of little more than 125,000,000 acres of land without contributions from abroad."†

* *Deutschland unter Kaiser Wilhelm II.* — † *Germany's Food Supply—Can it Last?*—page 232.

Agricultural Education.

Germany's extraordinary progress in agriculture is in no small measure due to the effectiveness of the machinery she has provided for diffusing and disseminating a knowledge of agricultural principles and methods throughout the community.

Professor Von Ruuken, of Berlin, summarizes the German view of agricultural education in this way, "The great progress that agriculture has achieved in Germany during the last quarter of a century is the result of union of practice with science, and proves that money spent on research and on education in every class brings in a high rate of interest, and is compensated for by increase in land taxes and of revenue from State railways."

Prussia proceeded to organize her system of agricultural education in a characteristic fashion. The first step was to set up several Departments of Agriculture of university rank, and provide them with funds for a systematic study of methods and principles underlying agricultural practice. Agricultural colleges were also established. Three agricultural colleges and four Departments of Agriculture of university rank have been established to (1) study principles and methods, (2) carry out research work in agriculture, and (3) train students. No less than 65,000 students passed through these institutions up to 1910. What influence these educated agriculturists had on farming practice cannot be demonstrated by statistics, but it is certain that the agricultural progress made during the past 25 years is in no small measure due to the leavening of the agricultural population by these trained men and the improved technical methods brought by these men to the various districts. When sufficient progress had been made with the study of principles and methods at the colleges and universities, and a sufficiency of trained men were available, Prussia set out to establish leadership amongst the farmers, and to provide for agricultural education in the elementary schools. Short courses of instruction were mapped out for farmers. These proved very popular, and over 36,000 attended in 1911. One hundred and eighty peripatetic instructors and official agricultural lecturers were employed to visit farmers at their homes and advise on farming problems.

Finally, Prussia established an official Chamber of Agriculture for each province. There was an official chamber in each Prussian province, with the German Agricultural Council acting as a central official chamber for the Empire.

According to a *Prussian Law* of 30th June, 1894, the chambers had the following tasks set them:—

1. To take account of everything that affects the interests of agriculture and forestry in their respective districts.
2. To help forward the technical development of agriculture.
3. To assist the administrative bodies by submitting information and advice on all questions relating to agriculture and forestry.
4. To assist in management and settlement of prices in the produce exchanges and markets.

In 1910 the income of the chamber was over a quarter of a million sterling, of which £160,000 represented a State subsidy, the balance being raised from farmers by taxation. With these sums the chamber assisted the State in carrying out its educational policy, and in helping forward the technical development of German agriculture.

The importance of the duties of the German Agricultural Council has greatly increased. The Kaiser has personally attended the meetings of the Council, and the Council has been handed important duties by the Imperial Administration.

The duty of dealing with political matters in the interests of farmers and of carrying on the political battle rests with the Association of Agriculturists (Bund der Landwirte). This Association was formed in 1893, and was a pressing necessity in order to rouse up the German farmers, who by nature are very inert as regards political matters, and to stir them up to a strenuous fight for those interests which had long been neglected and were threatened afresh.*

Technical Advances in German Agriculture.

The eminent position occupied by German agriculture to-day is largely due to the technical advances made in the cultivation of the soil, the feeding of stock, and the improvement effected in crops and stock.

The teachings of Liebig, the great German Agricultural Chemist, who first suggested the manufacture of superphosphate from bones, and established the importance of the mineral elements of plant food, became not only part of the agricultural education given at the colleges, but became part of the general knowledge enjoyed by educated farmers. His teachings formed a solid basis for scientific treatment and fertilization of the soil.

By carrying out Liebig's teachings to their logical conclusion, and using liberal quantities of potash salts, and phosphates, poor soils were raised to the rank of good soils, and good soils were made extremely fertile.

Germany, more than any other country in the world, appreciates the value of artificial manures. In 1890, 1,600,000 tons of artificial fertilizers were used. In 1912, with practically the same area under crop, no less than 7,000,000 tons were used.

The classic experiments of Lawes and Gilbert, at Rothamsted, extending over 70 years, demonstrate that high yields per acre can only be maintained by liberal applications of artificial fertilizers. The results of these tests have been summarized in neary every British text-book on agriculture, and make the basis of most discussions on artificial fertilizers.

It will doubtless come as a surprise to many to learn that the average amount of nitrogenous manure, expressed as sulphate of ammonia, used in Britain is less than 10 lbs. per acre. Similarly, barely 60 lbs. of phosphates, and less than 16 lbs. of potash, are used per acre. The following table summarizes the average amount of fertilizers, calculated

* Von Schwerin Löwitz, *Deutschland unter Kaiser Wilhelm II.*

in terms of sulphate of ammonia, superphosphate and kainit, used in Great Britain and Germany per acre of cultivated land:—

Fertilizer.	Per acre of cultivated land.	
	Great Britain.	Germany.
Nitrogenous Manures, expressed as Sulphate of Ammonia ..	·09 cwt.	·17 cwt.
Phosphatic Manures, " " Superphosphate ..	·57 "	·72 "
Potassic Manures, " " Kainit	·14 "	·73 "

It will be seen that the German farmer uses on an average twice as much nitrogen, one-third more phosphoric acid, and five times as much potash as the British farmer.

Germany has a great deal of light, sandy land to maintain in good condition, and this no doubt accounts for the comparatively large quantities of potash used.

The chief factors leading to the enormous increase in consumption of artificial manures in Germany have been the exact investigations at the experiment stations which established the uses and limitations of each fertilizer, and the information supplied by these institutions in the form of bulletins, leaflets, &c.

Large areas of poor sandy lands have been reclaimed and made wonderfully rich by growing lupins and other leguminous plants, and fertilizing them liberally with phosphates and potash. The crops were ploughed in and the soil rapidly brought into a condition for growing heavy crops of rye and potatoes.

Tracts of low-lying moor land, which are very rich in nitrogen, but incapable of supporting plant growth owing to defective soil aeration, were drained, covered with sand, limed, and liberally manured with potash and phosphates. These moors then produced fodder crops and root crops equal to the best arable land in Germany.

The most remarkable achievements of all were those obtained in the improvement of plants and animals by the adoption of systems of breeding which aims at a definite end. New varieties of rye, barley, oats, wheat, potatoes, and sugar beet were produced, which increased the yield of crops by 40-50 per cent. compared with the old sorts.

The case of sugar beet has already been dealt with. Thus in 1876 it was necessary to produce 11.62 tons of beet to obtain a ton of sugar. In 1912 the beets had been improved to such an extent that less than 6 tons of beets were needed to produce a ton of sugar.

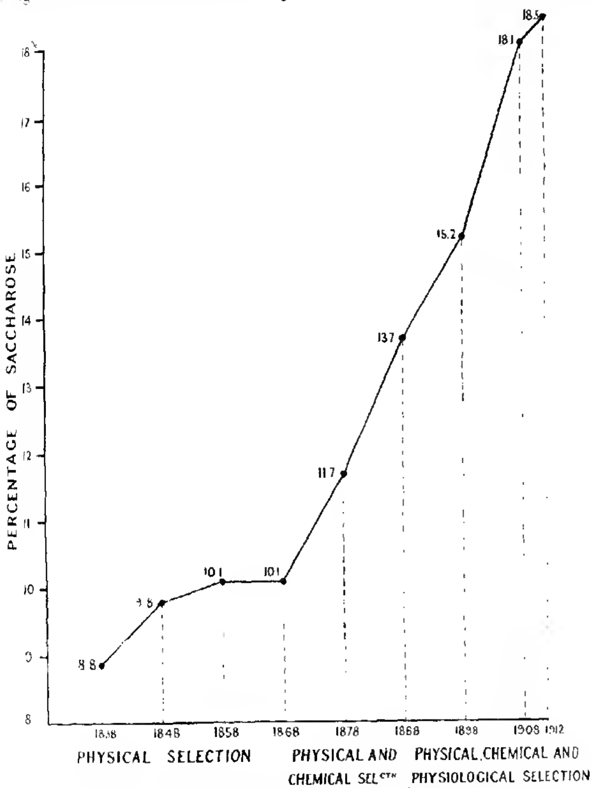
In addition, the Agricultural Engineer kept pace with the Agricultural Scientist, and supplied the farmer with up-to-date ploughs, seed-drills, binders, tractors, all of which helped the farmer to be less and less dependent on labour.

The aim of the educational policy was to impart to the farmer a better scientific understanding of the laws of nature, so that he would know the ideal conditions of soil for the best growth of each type of farm crop, and endeavour to realize these conditions in practice.

Germany established several important industries in direct association with her agriculture, and these have a considerable influence on

agricultural development. The chief of these industries are brewing, distilling, sugar beet, potato drying, and potato starch industries.

Besides establishing a good local market for agricultural produce, these industries support a considerable rural population which provides the agriculturist with labour at busy seasons.



GRAPH Showing improvements effected in sugar content of beets.

Organized Co-operation and Credit.

In no other department of German agriculture has the feeling of fellowship among the German farmers shown itself more than in the astonishing developments of the system of co-operation. It is difficult to say which has done more for German agriculture during the past ten years—the technical advances in agricultural methods, or the development of the co-operative system. It is probably correct to say that on large farms the improvements have been due to better methods

of farming, on the small farms the chief influence in improvement is due to co-operation—for it is through co-operation that the advantages of farming on a large scale are made possible to the small farmer. The more important of these advantages are—

1. The regulated purchase of raw materials, artificial manures, feeding stuffs, seeds, implements, bags, &c., which are necessary for farming.
2. Better prices for produce—milk, butter, eggs, fruit, grain.
3. Facilities for making use of personal credit at a cheap rate of interest, and of putting aside small sums of money that can be spared from carrying on the work of the farm, with the possibility of obtaining interest.

These are the important commercial advantages reaped by the man who farms on a large scale, and they have been placed within the reach of the small farmer by means of various local societies established for buying, selling, and farming co-operatively, and connected with savings banks and central associations.

Two million small farmers in Germany are members of co-operative institutions.

In 1910 there were 13,636 co-operative societies in Germany, with a yearly turnover of 859,000,000 marks. In 1912 there were 26,026 societies with a turnover of 6,341,000,000 marks.

As an example of their work, Cahill states that 620,000 tons of basic slag were bought in one year by a single German Agricultural Society. There were 571 co-operative implement societies in Germany, 600 electric supply societies, as well as potato drying societies and distillery societies.

A few beet sugar factories are run on co-operative lines, but as the amount of capital required for a factory is large, most of the factories belong to joint stock companies, though the beet is grown by the members on co-operative lines.

III.—WHAT WILL BE THE RESPONSE?

The Titanic struggle raging in Europe has brought home to the belligerents the vital importance of agriculture to a nation. As the war drags wearily on, it is more and more clearly recognised that agriculture forms a strong bulwark in a nation's defence.

Agriculture the Bulwark of a Nation's Defence.

Military valour and prodigies of military skill will not save a nation if its population is in want of food. Germany's encircling walls of men and steel will not save her from disaster if her agriculture fails to supply the foodstuffs necessary for life. Nor can the Allies cleave their way to final victory unless their people are properly fed.

In the early stages of the war the cry was for men; then came an incessant call for munitions, shells, and guns. Now the call is for foodstuffs. A few weeks ago the Chancellor of the British Exchequer (Mr. Bonar Law) is reported to have said that, so far as Great Britain was concerned, the British Cabinet had informed the War Office that it now regarded the production of foodstuffs at home as even more important than the supply of more men.

Taken in conjunction with numerous administrative acts, *e.g.*, fixing the price of foodstuffs for the next five years, and the utterances of

responsible statesmen on the food crisis, it foreshadows a new policy for stimulating and developing British agriculture. Such a policy will doubtless take into account both war-time requirements and the requirements of peace.

Obligations on the Farmer and the State.

In war time there is an obligation on the part of the farmer and an obligation on the part of the State. The farmer must raise the productivity of his land to the highest possible pitch of development with the capital, labour, and equipment at his command. The State, on its side, should give the farmer reasonable encouragement and, as far as possible, organized assistance with respect to the factors essential for production. Lord Selborne, in an appeal for increased production, shows the obligation resting on the farmer. "You have," said he, "something more on your shoulders than your own business to-day. You are no longer individual farmers making your own fortunes or losing them. *You are the trustees on your own land to do your best for England.* You have your duty quite as clear and as definite as the captain of a cruiser or a colonel of a battalion."

Germany prepared for Armageddon on an agricultural as well as a military basis. The State impressed on the agrarians that their obligation to the Fatherland was to make Germany agriculturally self-contained.

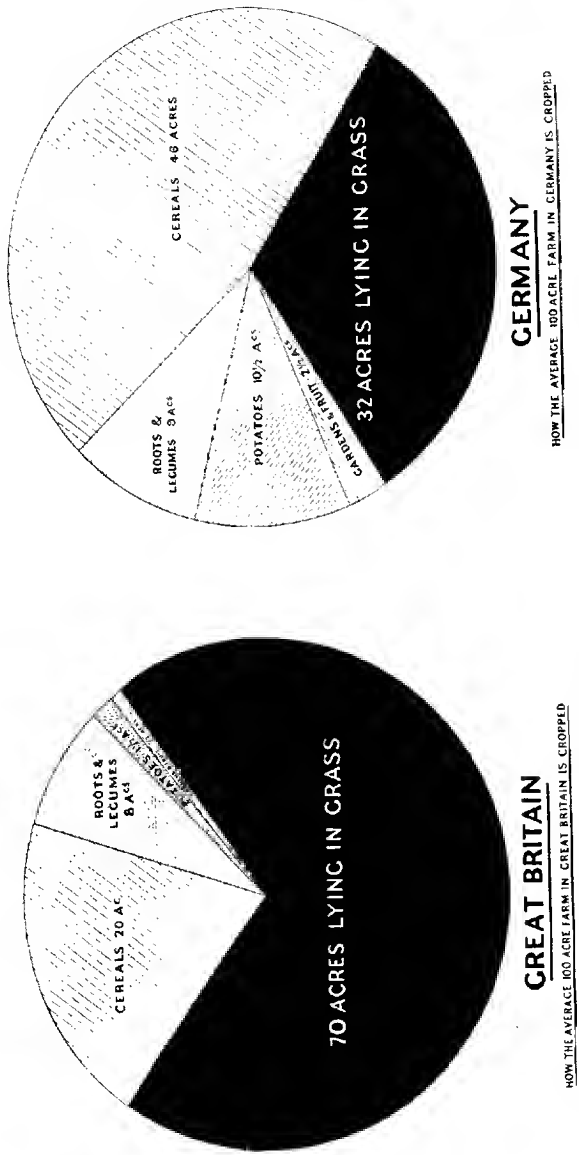
On the other hand, the State, by adopting an economic policy favourable to agrarian interests, and developing a thorough and comprehensive system of agricultural education, fulfilled its obligation to the farming community.

The results we have seen. Germany has surpassed Britain in crop production, live stock production, and in man-carrying capacity per unit of area.

Why Agriculture in Britain Lagged Behind.

The question now is whether Britain will organize and develop her agricultural resources and re-establish the leadership in agriculture that was once hers. Neither in respect to richness of soil, suitability of climate, nor in individual effort is Britain inferior to Germany. But in respect to organization of her agricultural forces and resources she has lagged behind. She has regarded agriculture as a sort of industrial step-child, with its needs subordinated to those of commerce and industry. Germany, on the other hand, realized the danger of becoming over industrial, and set to work to devise an elaborate set of machinery—administrative, educational, and commercial—for the purpose of leading, teaching, and financing her farmers and so developing the full resources of the State.

In comparing the systems of agriculture in Britain and Germany, the outstanding point of difference is the extent to which the plough is used. Taking the average of all farms in the two countries, we find that on the average 100-acre British farm approximately 30 per cent. of land is devoted to crops, and 70 per cent. is devoted to grass land. On an average the 100-acre British farm has 70 acres devoted to grass, 20 acres sown to cereals, 7 acres to roots and legumes, 1½ acres to potatoes, and ½ acre to fruit and gardens.



BRITAIN "SPEED THE PLOUGH!"

On the other hand, the average 100-acre German farm has only 32 acres devoted to grass, and no less than 46 acres to cereals, 10½ acres to potatoes, 9 acres to roots, sugarbeets, and legumes, and 2½ acres to orchards. In other words, in Germany over two-thirds of every farm is kept under the plough, whilst in Great Britain less than one-third of the cultivated land is ploughed. Herein is the main reason for the improved carrying capacity of German farms, for it is an axiom that tilled land will generally produce from two to five times as much food as land allowed to lie in grass.

Britain "Organize and Speed the Plough."

If agriculture, therefore, is to make headway in Britain, the first plank must be a policy of "Speed the Plough" and immediately increase the proportion of land sown to crops. Instead of less than one-third of the cultivated land being under the plough, as at present, at least one-half or two-thirds could and should be made to grow crops. But to double the area of land ploughed each year would require an enormous increase in the working capital and the farm labour of the country. This capital is required (*a*) to purchase equipment—ploughs, cultivators, seeding and harvesting machinery, (*b*) to finance the extra labour necessary for the work. But where are these two fundamental requisites for the extension of arable farming to come from? Capital is scarce, labour even scarcer, and the earnings both of labour and capital have been higher in industrial concerns than in agriculture. In spite of the high prices for all agricultural products in Great Britain during the war, agricultural production has not increased. A material extension in the arable area of Great Britain would be possible therefore only by diverting capital from other industries. Very few farmers have the capital necessary for a material enlargement of their arable area. Even if a farmer could secure the financial accommodation necessary, and could overcome the difficulty of securing efficient labour, he has still to consider the possibility of a bad season, or low prices, or both.

To be successful in arable farming, especially on high-priced land, plans must be made years ahead. Fat and lean years must be expected, and careful crop rotations practised. If a definite State policy is framed, and the State is willing to stand behind the farmer in lean years, and in times of low prices, capital will be attracted to agriculture, and an agricultural revival will set in. Such a permanent guarantee would be secured by (1) the fixation of prices for a period of years, or (2) by a protective tariff on foodstuffs. Either of these methods, if made permanent, would rapidly lead to an extension of arable farming, and attract the necessary capital for financing such extension. The discussion of these methods cannot be given here. That is a political problem, and lies entirely outside the scope of this article. It may be said, however, that European countries generally impose a protective tariff of 1s. 6d. to 1s. 9d. per bushel on wheat, and similar tariffs on other agricultural products. In these countries the whole community has been willing to pay a higher price for its food and meat rather than let home agriculture languish from the competition of foreign-grown products.

The Prime Minister of Great Britain—Mr. Lloyd George—in a recent speech on the importance of home production, said, "There has been a lamentable neglect of agriculture. About 70 to 80 per cent. of our important foodstuffs come from abroad. We must put forth every effort to increase production this year. Farmers must increase their output immediately, otherwise we might have to choose between diminishing our military efforts or underfeeding our population. Labour is again partly the obstacle. *Increased cultivation with the plough is our only hope. We must cure the farmer of 'plough fright.' We must guarantee him minimum prices for a definite period.*

"The corollary of this is to secure better wages to the labourer. Rents must not be raised because of the Government's guarantee, and the Board of Agriculture must have power to enforce cultivation. *We cannot allow an injustice towards the community by a man sitting on land capable of producing food.* We propose to fix the price of wheat at 7s. 6d. per bushel this year, 6s. 10½d. for 1918 and 1919, and 5s. 7½d. for 1920-22. After that the guarantee will end.

"With this guarantee I hope that farmers will put their backs into the work, and help to defeat the greatest menace that has ever threatened our shores. I do not believe that the farmers will fail. They need not apprehend that the State in the future will be indifferent to the importance of their industry.

"Whatever befalls, no Government will ever again neglect agriculture. War has taught us that the preservation of this essential industry is as important a part of national defence as is the maintenance of the army and navy."

Economic Policy and Agricultural Education.

There are two, and only two, avenues for speeding up production, namely, increasing the area devoted to agriculture, and increasing the efficiency of the farmer. The former brings more acres under cultivation, the latter makes for higher yields and bigger production per acre. Both accelerate agricultural production. Increase of acreage is, as we have seen, a matter of increased capital, labour, and equipment, and a profitable price for agricultural products. In other words, it is largely influenced by the economic policy adopted by a State. The other factor, efficiency, is dependent on the knowledge, mental equipment, and skill possessed by the farming community as a whole, and can, therefore, be immensely stimulated by a sound and comprehensive policy of agricultural education. Germany's progress in twenty-five years is the most striking illustration of these basic facts. If, therefore, a State is to encourage agricultural production, it must adopt (1) a sympathetic agrarian policy, (2) a liberal policy of agricultural education.

Matters affecting policy cannot be discussed in this journal. It may not, however, be out of place to express the hope that in the economic reconstruction which will follow on the declaration of peace, adequate measures will be framed to produce within the Empire a larger percentage of the foodstuffs required by the Home country.

In 1914 Great Britain imported foodstuffs to the value of £300,000,000, made up as follows:—

	£
Grain and flour	89,636,269
Meat	63,215,059
Other food and drink	146,754,814
	299,606,142

Of these the Dominions and other British Possessions supplied the following:—

	£
Grain and flour	30,975,498
Meat	16,302,752
Other food and drink	36,090,668
	83,368,918

In other words, of the total foodstuffs required by Britain, only 27½ per cent. were produced in the whole of the British Empire, and no less than 72½ per cent. were obtained from foreign sources.

Of the total grain and flour imported, barely 5 million pounds worth, or 5.5 per cent., came from Australia. Of the total meat imports, 6 million pounds worth, representing 9.9 per cent. of the total, came from Australia. A Dominion eminently suited for the production of cereals and meat was only able to supply the Home Country, therefore, with 11 million pounds worth of grain, flour, and meat, out of a total of 153 millions required.

The position is even worse with regard to dairy products. In 1913, the year before the war, Great Britain imported the following products:—

	£
Butter	24,083,658
Cheese	7,035,039
Eggs	8,652,800
Bacon and hams	21,288,646

Of this Australia supplied the following:—

	£
Butter	3,210,733
Cheese	21,568
Bacon and ham	Nil

The Dominions are eminently suited for raising all the foodstuffs required to make up any shortage in Home production. The adoption of an economic policy whereby Britain would give a substantial preference both to foodstuffs produced at Home and in the Dominions, as compared with foreign-grown products, would stimulate agriculture throughout the Empire. In return preference might be given by the Dominions to articles which they cannot at present manufacture.

The Dominions are in need of settlers of the right type to fill their vacant spaces and develop their agricultural resources. They are in need of capital, too, to extend railways, improve road and transport facilities, conserve water supplies, promote irrigation and closer settlement, create new agricultural industries, and develop more intensive systems of agriculture.

The Dominions have the land, but they require settlers and agricultural labourers to work the land, and capital to provide for the above necessary developmental works. Immigration, land settlement, and Dominion development will be the big political post-war problems.

Agricultural Education and Research.

To her comprehensive system of agricultural education and research Germany largely owes her amazing progress in agriculture. Despite her unfavorable climate and average quality of soil, German production—measured in terms of aggregate output per farm, or average yield per acre—stands at the head of the agricultural countries of the world. The aim of the scheme of education was the union of science and practice, and perfection in technique. Germany organized a scheme of education which provided for the—

1. *Adult* farmer, by the establishment of legally-constituted Chambers of Agriculture, a Central German Agricultural Council, and by providing experimental stations, peripatetic instructors, and literature relating to every phase of plant and animal husbandry.
2. The *youth*, by means of graduated agricultural instruction extending from the schools to the Agricultural Colleges and the University.
3. For *Research*, by providing well equipped Agricultural Experiment Stations throughout Germany, and several Departments of Agriculture at the Universities.

   The objects of these institutions was to prosecute research work, make a thorough study of methods and principles and train the future agricultural leaders of Germany.

Britain and her Dominions cannot afford to do less than what Germany has done. Indeed, if Britain is to re-establish her leadership in agriculture her organization in agricultural education must be even more thorough than Germany.

Government grants for agricultural institutions in Germany have hitherto been on a much more liberal scale than in Britain. The expenditure on agricultural instruction in Prussia alone was £484,000 in 1910. The total expenditure in agricultural education in England and Wales for the same year was £117,000.

The ultimate objective of any scheme of agricultural education should be to increase the agricultural output of the State. This may be achieved (1) by making the present generation of farmers more efficient by diffusing among them a knowledge of the scientific principles underlying their industry; (2) by giving the farmers of the future, *i.e.*, the boys and youths of the present day a sound training in agricultural science and practice. All progressive agricultural countries provide organizations for achieving both these objectives. The agricultural output of a State may be temporarily stimulated by tariffs, or fixing of prices for products, bonuses, and other artificial aids; but the only way to secure a permanent increase in output from the land is to improve the farming methods of a country, and apply the teachings of science to its agricultural practice.

Provision must be made for (1) the application of existing knowledge in all branches of plant and animal industry; (2) the acquirement,

by means of experiment and research, of new knowledge which will form the basis of future improvements in the practice of agriculture.

The application of science to agriculture, however, requires a body of trained agricultural scientists; some to engage in research work and attack new problems, others to apply existing knowledge to local problems, and show how the adoption of correct farming methods inevitably increases the output.

We require a body of trained workers to act as evangelists who will spread the gospel of better farming methods, and transform those who at present farm by rule of thumb into active apostles of the profitable practices dictated by the achievement of science.

At the risk of wearying the reader, let us consider a few simple truths, the widespread application of which in Victoria would increase our aggregate output by at least 50-60 per cent. Among a few of the technical improvements that might be suggested for Victorian practice are—

(1) The more extensive use of fertilizers in top dressing pasture lands, especially in the moister districts of the State.

(2) The value of more liberal applications of artificial manures in increasing wheat, lucerne, and potato crops.

(3) The value of selection in raising the prolificacy of our farm crops, particularly wheat, cereals, and potatoes.

(4) The adoption of crop rotations suited to the climatic conditions—

(*a*) The more extended use of bare-fallowing in the drier districts.

(*b*) The use of forage crops fed off with sheep, to take the place of fallow in the moister districts.

(5) The use of regular and systematic crop rotations in cereal growing, dairy farming, and potato culture.

(6) The use of underground drainage in wet districts.

(7) The wider use of forage crops in wheat and sheep farming.

(8) Extending the area under tillage on dairy farms, to increase the supply of forage crops and foodstuffs.

(9) The systematic feeding of dairy stock and the use of balanced rations.

(10) The general adoption of herd testing on dairy farms to eliminate unprofitable animals.

(11) The use of pure bred bulls, bred from animals of proved milking capacity.

(12) The use of immature seed and sprouted seed in potato culture.

(13) The use of lime south of the Dividing Range and in Gippsland.

(14) The use of proper methods to control insect and fungoid pests of farm crops, particularly smut and takeall in wheat, Irish blight in potatoes, eelworm in onions, aphides, scale, &c., in fruit.

(15) The use of the most efficient types of machinery to counter the increasing cost of labour.

(16) The benefits to be derived from co-operative buying and selling of all forms of produce.

If the technical improvements which have been evolved during the past 20 years could be put into practice by the majority of our farmers our aggregate production per acre would increase by at least 50-60 per cent.

German and American experience have definitely shown that the type of adviser suitable for this work is one who has had a thorough training in the application of science to agriculture. The Germans began their scheme of agricultural education with a systematic study of principles and methods of farming at the Universities. It first trained the men, and, when a supply of trained men were available, it proceeded to organize agricultural instruction in the schools and colleges.

We also require a body of research workers to tackle problems of immediate importance to our primary industries.

That the British Government has realized the importance of research work in agriculture and live stock may be gathered from the operations of the Agricultural Development Commission which was appointed under Acts passed in 1909 and 1910 to promote agriculture, forestry, and rural industries.

The Board aims at—

1. Increasing the output of agriculture by assisting the extension of a system of scientific investigation and research.
2. Extending educational facilities to insure that the results of the research are known and realized in practice.
3. To encourage the organization of co-operation.

In 1913-14 the Board spent on agriculture and rural industries £472,793, as against £227,600 in 1912-13. The main items of expenditure in 1912 were as follows:—

	£
Agricultural research (maintenance)*	46,965
Grants to Universities and Colleges for equipment and buildings for agriculture	26,895
Veterinary laboratory	28,650
Live stock breeding	44,800
Cattle testing station	20,000
Forestry education	20,900
Encouragement of sugar beet	11,000
Encouragement of co-operation	6,000

The Commonwealth Government has intimated its intention of establishing a permanent organization for scientific research in relation to industry. Though no details as to the nature of the permanent organization have been announced, it is probable that considerable prominence will be given to the solving of problems associated with our primary industries.

These efforts, showing appreciation of research and organized educational effort in agriculture, are very fine, but the unfortunate thing is that they were made some 25 years later than Germany. Germany not only has a long start, and has accumulated a mass of information of extreme value to her farmers, but her progress from now on must be much more rapid, because she has a generation of farmers who received a technical and scientific education in agriculture in their youth.

* *Journal of Board of Agriculture*, October, 1914

To make up for that handicap in the race for agricultural supremacy, Britain and her Dominions must be prepared to spend large sums of money on agricultural education and research. We do not have to look across the Rhine to seek examples of good tillage and high production. Here in Victoria we have individual instances of wheat farmers, dairy farmers, and potato growers, whose methods of farming are on a high plane of efficiency, but, unfortunately, such cases are rare. The majority of our farms are cultivated with only average skill, and this is the reason for our low average yields. The great task ahead is to lift the average farming towards the plane of the best—to encourage the Many to do what the Few are doing. To do this we do not even have to discover any new knowledge; we only need to apply principles and methods that are already well known.

But while the systematic application of present day knowledge to all farms in the State would inevitably lead to an enormous increase in output, we must not imagine that the summit of technical perfection would then be attained.

In respect to nearly all branches of agriculture—the choice and selection of seed—the rational use of artificial manures, the use of foodstuffs for stock, the use of machines for economizing labour and cheapening production, the improvement in live stock, the production of new and more prolific types of crops, the winning to agriculture of new lands—we are only beginning to realize the vast possibilities for improvement that are opening up along these avenues. For the discovery and utilization of this new knowledge a comprehensive system of research is necessary. Agricultural education and research must therefore go hand in hand in any progressive scheme for rural advancement, the former applying the knowledge already won, the latter elucidating new facts which will form the basis of future progress.

. . . .

The German challenge for agricultural supremacy is the challenge of organization and efficiency. It must be met by better organization and increased efficiency.

The clash of war found Britain unready—in military, industrial, and in agricultural organization. By stupendous efforts and at great cost military and industrial organization has been created in three years which has outfought the best military machine hitherto created. The task of organizing agriculture is now being undertaken. The State in future must play a greater part in developing and fostering rural interests and industries. Mr. Runciman recently said, "A country which fails to regulate and foster industries in the national interest cannot, in the nature of things, long survive the rivalry of another country where the industries are so fostered and regulated." Ancient democracies tended to repress the free life of the individual. Modern democracies tend to err in the other direction, and adopt a policy of *laissez-faire* under which an industry of national importance may languish. The war has shown us that a State, whilst allowing individual liberty, must adopt a constructive policy and provide the necessary administrative machinery to develop to the utmost possible limit all the manifold resources of the country.

INCREASE THE WHEAT AREA.

A National Requirement—A Personal Advantage.

By Temple A. J. Smith, Chief Field Officer.

There are many land-owners in Victoria who can materially assist the Empire, and at the same time their own individual interests, by increasing the production of essential food supplies for those at present engaged in fighting against the Central Powers for the lives, freedom, and general welfare of those, who for various reasons, have not been able to offer their services in the firing line, or as assistants in Red Cross, munition or other work actually connected with military operations. It is a well-known saying that "an army fights on its stomach," and it is obvious to the smallest intelligence that a starving or even a semi-starving army cannot have the same efficiency or endurance as the same body of men fighting on good food. Moreover, badly-fed men are more subject to disease, and even under the best fighting conditions the losses from sickness are most serious, being in some cases greater than the casualties received in actual warfare.

Every man and every woman in the Empire is liable to be affected by the result of the war, therefore, each and very one should do their utmost to assist in making the outcome a conclusive victory for the Allies. Situated as we are, far from the actual scene of operations, it is difficult to realize the awful struggle now taking place in Europe, but should failure to secure a decided victory over the Central Powers be the result, the future of Australia must be jeopardized and the ambitions of its people in all probability be ruined. Should by any chance the German submarine menace accomplish its threat to starve England into submission, Australia, looked upon as the pearl of the British Empire, would almost certainly be taken over by our enemies, when the stern rule of the Germans would render the conditions of life unbearable to the freedom-loving Australian, who would be reduced to serfdom with no ultimate hope of again rising to the surface.

Before it is too late, every individual in this Commonwealth should ask himself the question, "How can I help?" and undoubtedly *every man engaged in primary production can help* by making a special effort to increase the output of all exportable products necessary for the successful conduct of the war. Every additional bag of wheat produced means the maintenance for six months of a man in the firing line, or in any position assisting towards victory, and every additional bag of wheat means increased profits to the producer. England must rely chiefly upon her own Colonies for food and clothing supplies, the ordinary sources of supply being closed. Russia is so situated that her wheat cannot be exported; Servia and Roumania are in a similar condition; France, owing to her depletion of man power, and the extraordinary demand in her own dominion, has nothing to spare. The strong probability of the United States being drawn into the war will cut off further supplies; all of which circumstances demand an extreme effort on the part of Victorian farmers to make good any deficiency arising from such a combination of conditions.

The waste which takes place during war time renders it imperative that larger supplies than are required in times of peace be made available, and, if possible, a surplus should be produced much above the normal consumption. The sinking of wheat-laden vessels, the destruction of food transports, the inevitable waste in supplying troops on the battlefield, all tend to make a surplus amount of breadstuffs necessary in time of war. England, herself, cannot hope to increase her output of wheat to any appreciable extent, owing to her limited areas and the fact that her man power has been drawn on to an enormous extent for fighting purposes.

The duty, therefore, of Victoria and of Victorians, is to do all that is possible to keep up the food supply, to put in every acre that can be put in, and so help the Empire in the great cause she is so gallantly fighting.

It may be said that the many fine men we have sent to the front will leave us short of labour for the purpose of ploughing and harvesting, and their absence will no doubt prevent as large an area being grown

Preparing the Land for Wheat.

as would have been the case had they been here, but with the improved machinery for working the land, and harvesting the crops, the area workable per man has been increased threefold, and the very fact that fewer men are available renders it still more incumbent upon those remaining to make a supreme effort to do the work, and send the Mother Country sufficient for her requirements in her time of need.

The Personal Aspect.

Reviewed from the personal aspect, such a proposition must appeal as a patriotic one, and on that ground alone it should achieve its aim to secure an ample food supply for our own men and others fighting for our rights and privilges, perhaps our very lives. Apart from patriotic or sentimental grounds, however, the appeal for increased production may be made to rest upon the personal and national advantages that will accrue. Every additional bag of wheat, every extra fleece of wool, every supplementary pound of cheese produced,

means an increased sum of money to the individual and a greater capacity for the State to meet its much increased obligations. This is not empty conjecture, but actual fact; prices for these commodities have been guaranteed, and the producer is in a position hitherto unknown, in that he knows that, given a normal season, he can rely on a certain profit. Never before has it been so necessary that primary production be pushed on, and never before has the profit been determinable beforehand. The heavy costs entailed by the war in the shape of the national debt, the interest bill on which must be paid from our exports, render it imperative that everything possible must be done towards increasing production.

Present Position of Area.

In years 1915-16 the area under wheat totalled 4,013,420 acres; in the years 1916-17 the estimated area fell to 3,338,000 acres, and unless

Sowing the Wheat Crop.

special energy is devoted to increasing the area, a further decline is possible.

There is room for great expansion in the Mallee, the Western district, also in smaller ratio in the Wimmera, the Northern, North-Eastern, and central portions of the State. Gippsland also might considerably augment supplies; fine yields of wheat have of recent years been grown in the Tangil, Buln Buln, and Dargo counties, and these areas could easily be greatly extended.

At the present time only one-half (.5 per cent.) of the wheat produced in Victoria is grown in Gippsland, only four and three-quarters (4.75 per cent.) in the Western and two and one-third (2.33 per cent.) in the North-Eastern portions of the State. In the North-Central but one (1.0 per cent.) is grown, and in the Central a little over three-quarters (.75 per cent.).

It is obvious then that the areas under wheat in these districts can be increased very considerably, provided the inclination is backed up with the requisite energy.

Lord Kitchener said this war would be a war of attrition, and that it would probably last for years, and his forecast has proved correct. It has been proved undeniably that the powers that can hold out the longest in respect to men, food, ammunition, supplies, and money will win. It is not a question of the best fighter, but of the longest purse and best supplies. Failure in any one of these factors would end the war for either side in double quick time, and we can, at least, do our share in seeing that at any rate our troops will have a sufficiency of bread to keep them up to a fit standard as fighters.

How an Additional Area can be Obtained.

Let every man according to his circumstances say, "I will put in an extra 10, 50, 100 or more acres; I will then be assisting the Empire and those gallant men who are fighting my battle, and doing what is in my power towards helping the great cause."

If each man who can will do this an additional 500,000 acres can be put under crop. Taken at an average return of 10 bushels per acre, 5,000,000 extra bushels of wheat will be produced, *sufficient to feed 500,000 men for one year.* Possibly, as in the case of the additional 20,000 men who were hurried up at the right moment when Manoury was turning Von Kluck's flank on the outskirts of Paris, this extra supply of wheat might turn victory to our side.

There are methods by which the yields of crops can be increased apart from additional acreages. Larger amounts of phosphatic fertilizer per acre is one of the simplest. The average farmer has not yet realized that bigger yields and more profitable returns are reaped from applications of heavier dressings of superphosphate per acre as compared with lighter dressings.

The drought of 1914-15 has left the country short of stock of all descriptions. The natural consequence is that much land ordinarily used for stock is not being turned to a useful account. A fair proportion of this idle land could be cultivated for wheat, maize, &c., and so be made to return a profit, and at the same time provide its quota towards winning the war. Uniform individual effort is the key to the situation, and when every individual in Victoria recognises that his or her help is needed, and that his or her help must be given, then will the weight that we can bring to bear be felt, and our influence on the war be of value to the Empire. Germany's strong position to-day is due to her wonderful organization and unity of purpose. She realized that food supplies produced within the confines of her own territory were as necessary for military purposes as men, guns, and money, and for many years before hostilities commenced developed her primary industries with this object in view.

Are we who are left in Australia to be found wanting? Australians have proved that they can rise to occasion, and what greater occasion can arise to demand our strongest effort than the crisis which now confronts us?

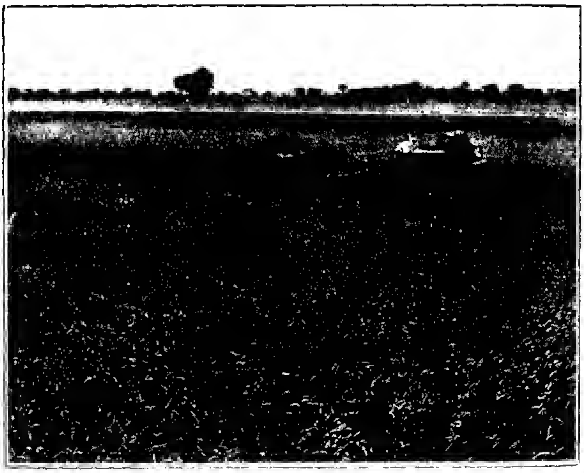
FARMERS, WIN THE WAR!

H. A. Mullett, B.Ag.Sc.

The Spirit of Self Sacrifice.

In August, 1914, the sudden thunder of the great guns aroused mankind from a deep sleep; in the twinkling of an eye all Europe was aflame from end to end. During the mighty struggle that followed many time-honoured customs failed to meet the new conditions, and were tossed aside; men long trusted for their sagacity and statesmanship crumpled under the strain, and even whole nations have been cast into the melting-pot.

It is an age of big things, of noble deeds; but if there is one thing that has stood out nobler than any—clear cut from all the rest—it is the amazing subordination of self-interest by so large a section of the people for the good of the community as a whole. It was this spirit of self-



Gathering in the Golden Grain.

sacrifice that stemmed that first great rush of the enemy hordes, and gained for the Allies valuable time; it was this spirit that enabled them to hold on and subsequently plan the counter, the full weight of which is now being felt by the enemy. This point has not been reached without a supreme effort of self-sacrifice by the people of the British Isles and their Allies.

In France, every able-bodied man between the ages of 18 and 60 years is engaged in war work; while at that work he receives the pay of a soldier, which is but a few pence a day, and as a soldier he may be called upon to work night or day. Every man in Belgium, Servia, and Roumania is serving in the Allies' cause, while in Great Britain many

[...]tions, including no less than 500,000 women, are engaged in war work, an[d] each day sees another industry give way and come into line with the [re]quirements of war.

Thus, every activity not a vital one has been subordinated to the needs of the Empire, and to-day the British Isles literally throb from end to end with the work of munition making. In great arsenals, spreading over hundreds of acres, subject to the ever present danger of Zeppelin raids and of premature explosions, these workers toil night and day to assist their fellows in the trenches. The work of these factories never ceases, and every conceivable labour-saving device is used; yet the cry for more guns, more shells, more men, goes up.

The Need for Increased Production.

Consequent upon the drain on the workers at the normal occupations of peace times, the agricultural production of the countries engaged in the conflict has fallen away very considerably; but all this was foreseen, and has been provided for in the great national scheme of things. In a word, it has only been possible to carry on the war by arranging for the concentration on the manufacture of munitions by the countries nearest the scene of the fray, and by those countries most highly organized industrially.

It is War Work to put in an Increased Acreage: It is War Work to Increase Your Yield per Acre.

The provision of the foodstuffs has, therefore, necessarily been left to those further afield, and there is not the slightest doubt that the huge demand for wheat and flour from the overseas Dominions will continue, not only for the period of the war, but for some years to come. It is only necessary to consider for a moment the conditions in Europe to realize what effect the war has on agricultural production. The type of agriculture in Europe is intensive; that is to say, a great deal of preparation and manuring is necessary to secure the high yields obtained. Seeing that there is so little labour available—labour which is often unskilled—and, further, that there is a deficiency of potash in the Allied countries and of nitrates in Germany, it follows that the normal high yields of those countries cannot be maintained during the war. After the war there must be such a demand for constructional work, such as repairing damage to houses, bridges, railways, &c., that agricultural workers will be scarce, and the greatest difficulty will be experienced in getting anything like normal acreages under crop. Then, again, the wastage of wheat and flour in war time is enormous. In the devastated countries, whole stacks were burnt by retreating armies, and large areas under cereals laid waste.

With the Central Empires, on the one hand, living from hand to mouth, and the Allied countries, on the other, unable to find labour for agriculture, the demand to replenish supplies from overseas after the war will be enormous. *Any farmer citizen of Australia who is unable to go to the front has, therefore, a clear call to do war work along with the munition makers of the Continent, and his particular task is to feed these toilers, and feed them well. He, no less than the maker of guns and shells, and the fighter in the trenches, is called upon to do his bit, and to do it just as efficiently.*

Finance: By Increasing Production the Farmer is Helping to Maintain the Financial Stability of Australia and the Empire.

The questions of War and Finance are closely bound up in each other: On every hand we hear that money is "tight," that the rates of exchange and interest are high—that there will be increased taxation to meet this. Now, every man that brings increased acreage under the plough, quite apart from any question of profit, is helping to minimize the taxation on himself and incidentally on everybody else. The reason is that, in a young country like Australia, where considerable development is going on, our exports are not yet sufficient to pay for our imports, and the difference has to be paid for in actual cash—money which, if applied in other directions, would command a high rate of interest; so that it is specially good business at the present time to reduce this difference to a minimum by maintaining our trade balance.

Looking further afield, it is now recognised as undoubted national economy for the British people to be able to obtain as much wheat as

"Win-the-War Wheat" on the way to the Railway Station.

(Food for a battalion for three months.)

they can get from the Dominions overseas, and so keep the money within the Empire.

It is Good Business to Sow a Large Area this Year.

There are two main differences that separate the business of agriculture from that of any manufacturing concern, such as a factory. The factory manager can control each stage in the manufacture of his product, and, generally speaking, makes an article to supply a definite want. The farmer, on the other hand, is subject to a climatic factor and to a market factor. Once his crop is sown he must leave it to the tender mercy of the elements, and his market is indefinite; that is to say, one year there may be a widespread shortage, and prices be very remunerative, but at another time there may be a world surplus, and prices fall away to nothing.

When the Federal Government guaranteed that the farmer should not get less than 4s. a bushel (and probably more) for all the wheat he could produce, it accomplished something unparalleled in the agricultural history of Australia; in a word, it put agriculture on the same footing as any other business, insomuch as the market factor was made definite.

Again, every farmer in the wheat area of this State knows that rainfall is normally the limiting factor in the growth of wheat; his whole system of tillage is directed to conserving all available moisture; he is willing to sacrifice the use of his ground every alternate year in order that he may carry forward for the use of the next crop some of the moisture that is saved. He strives by every means in his power to make himself independent of the rainfall; if he could but eliminate the climatic uncertainty he knows that all would be well.

The past season has been remarkable for its abundant rainfall; for twenty or thirty years never has there been such a phenomenal and continuous downpour. The summer has been notably cool and free from hot and dry winds, and the conditions absolutely ideal for the conservation of moisture. The long soaking rains have thoroughly

Awaiting Transport.

replenished the subsoil, and never before has the farmer had such an asset with which to begin his season's work. The second, or climatic, factor in the agricultural business is, therefore, more favorable than it has been for years; *in short, the farmer is placed on a better business footing than he ever was in our agricultural history.*

Therefore, for the two reasons given, the growing of wheat this season has the best outlook that it has had for years. It should be borne in mind that the concurrence of the two conditions may never be repeated. Next year also the price should be all right, but will the moisture be there?

In a country like Victoria—subject to uncertain seasons—no farmer can afford to let this opportunity slip by. The producer, with his wheat in the hands of the Pool, is free from any possible business manipulation, and from middleman's profit. He will receive every penny after the cost of handling has been deducted, and the Pool, backed by the Government of Australia, can get a better hearing with the Imperial Government than any private firm could hope to obtain.

In this year, 1917, then, with the eyes of the world directed to Australia and things Australian, are the farmers going to rise to the

occasion, as did their comrades at Gallipoli, and help on the greatest cause the world has known—help it under the most favorable business conditions to themselves?

We have seen *why* the nation wants increased production; let us now turn to see *how* it can be effected.

It cannot be done without the intelligent application of New Knowledge to our agricultural practice, supplemented by Finance and the efficient application of hard work.

New Knowledge.

1. Superphosphate.

Is every farmer in the Wimmera, the Northern and North-Eastern Districts alive to the fact that 1 cwt. superphosphate applied with the seed has, under properly-controlled conditions, been conclusively proved to be a more profitable dressing than the smaller quantities usually applied? The difference in these tests was not apparent to the eye, but the harvester told the tale! Does every farmer in the Mallee use superphosphate, and does he know that for the past two years 60 lbs. have shown the best results?

Superphosphate will not burn the land! But on new land ½ cwt. only should be used.

2. Moisture.

"Every inch of rain conserved in the fallow means an extra bushel of wheat at the harvest."

Work the fallow as often as your team strength will permit without getting the surface too fine. The spring tooth is an excellent implement for working up fallow; it sifts the small lumps to the top and the finer soil to the bottom, making a consolidated seed bed ideal for wheat. Keep the weeds off your fallow; they use up valuable moisture. Don't be afraid to work the fallow after every rain if your team strength will permit.

3. Varieties to Grow.

Does every farmer know that on the average the chances are in favour of his getting the best results from several varieties of wheat, say, three. The seasons vary, and the aim is to get at least one to do best. He should sow a late wheat, a mid-season wheat, and an early wheat.

The following wheats have repeatedly demonstrated their superior yielding capacity for the past five years against all-comers:—

Federation.—Mid-season, short-strawed, prolific variety.

Yandilla King.—A late wheat, somewhat tough to thrash.

Penny.—A wheat maturing somwhat late; does well both in wet and dry districts.

Major.—A late wheat, which did very well last year.

Currawa.—A late maturing wheat.

Dart's Imperial.—A well-known mid-season to late mid-season variety.

Gluyas.—An early maturing variety, drought and rust resistant, very suitable for sowing late, should the drilling be protracted

4. Use Select Bred Varieties.

It has been proved that it is possible for a skilled observer to pick out plants of a more prolific strain from any given variety of wheat. The average farmer has not the time nor the skill necessary to do this. The Department of Agriculture does this for him, and can supply from one of its seed stations select bred pedigree seed wheat, true to type, and guaranteed of high-yielding capacity. Many farmers are growing these wheats, but there are many more who are not reaping the benefits provided for them.

Finance: The Key to a Bigger Acreage.

A bigger acreage is a question of money. Many farmers have the land and the plant, but they have not the ready money to pay extra hands, to pay for extra horseflesh, extra superphosphate or seed. If they had the capital they could break up new land, and take advantage of the conditions that now offer. If the capitalist—the man with money to invest—could be induced to take an interest in agriculture, additional areas might be sown at a profit to himself and the farmer.

It may be of interest to quote the experiences of a Melbourne business man. In 1915 he financed 204 acres in Borung and 500 acres in the Mallee. He paid the farmer a fixed sum for putting in and taking off the crop, and supplied two-thirds of the seed and manure, and took two-thirds of the crop. For a total investment of £890 19s. 9d. he received 6,678 bushels of wheat at the railway siding, and 52 tons of hay, and he reaped a net profit of £500 for his outlay of £890. Both the farmer and the investor were satisfied with their joint operations, and it would not have been possible to put in this 700 acres of land but for the financial assistance.

In 1916 further contracts were entered into for 1,000 acres, including 580 acres in the Mallee.

The figures for the Mallee are now to hand, and they show that the capitalist made a net profit of £727 18s. 2d. for an outlay of £688 1s. 10d. —that is to say, he more than doubled his money.

The following are the details:—

170 acres fallow	3,090 bags	
110 stubble	450 "	
	3,540 bags	
Two-third share of crop, 2,360 bags = 7,080 bushels, at 4s...		£1,416 0 0
Cost of producing same to investor, including fallowing, drilling, harvesting, carting, bag sewing		688 1 10
Profit		£727 18 2

These figures speak for themselves, and show what is to be done if investors go about the business in the right way.

Efficiency: The Policy of Speed the Plough.

Industrial efficiency is the science of getting the maximum work accomplished from a given expenditure of energy. It is the art of getting more and better work done in a given time with the same labour. The successful farmer is the man who can make the most of his labour, a certain percentage of which is absorbed in paying working expenses: all over that represents the profit.

A study of the question has brought to light the fact that definite general laws govern the performance of any set of operations, and that by the application of certain principles suggested by those laws, almost any sort of work can be speeded up.

Efficiency principles are concerned with four things—

1. The establishing of what is the standard of work.
2. The ferreting out of the slowest or limiting operation in any series.

A Contribution to the Sinews of War.

3. The keeping of accurate records.
4. An efficiency reward.

These industrial principles, first developed in America, and then applied with success to great manufacturing concerns, are worth the attention of agriculturists. They are particularly applicable to the speeding up of any work that consists of the performance of a series of similar operations by hired help, such as ploughing, drilling, harvesting, &c.

That there is plenty of room on the average farm for improved business methods no one will deny, so let us for the period of the war, at any rate, speed up and cast overboard obsolete methods, and bring ourselves into line with the great munition factories, where these principles mentioned above are an integral part in the factory routine.

Establishing the Work Standard.

"An acre a furrow a day" is a recognised standard of work—but it is not exactly what is meant by an efficiency standard. Most farmers rely on merely working long hours and on keeping their teams going to cover the ground. Efficiency means something more than that.

It seeks to find out what extra work could be done in the same time with the same labour; it subjects every single operation in every round of each implement to searching examination to see if the time and manner of doing it cannot be improved upon.

To be sure, none of the faults enumerated below are new to farmers, but the systematic weeding out of them with a view to increased efficiency is new. For example, the plough—an old one, often repaired—is discovered to be turning over a sod of 6 inches instead of seven in the case of two furrows. An alteration to the normal will increase the area ploughed by more than a quarter of an acre per day, and it is this little extra that is all profit.

Somewhere in France.

Ten bags of wheat will keep these 16 men supplied with bread for twelve months.

Again, most farmers are content to lap almost half a leaf of the harrows, in order to make sure that no ground is missed. Straight driving is a great aid to efficiency, and can always be accomplished under almost any conditions if the driver will take the trouble to look well ahead, and fix on a couple of clods of earth to drive to.

The farmer sends his man out to plough such-and-such a paddock without any definite instructions. Later he goes out, and finds the man ploughing the land in the direction of its shortest length—wasting valuable time in turning that might have been spent in work.

The efficient farmer must understand all these little drags on the work, and be always looking for them, and *planning* to eliminate them. The amount of work he can do in a day under *the most efficient conditions* is the *work standard* for that particular job. He may not be always able to achieve it, and it will vary with the conditions; but, nevertheless, he should know exactly how much can be done under all conditions, and strive to achieve this.

Seeking the Limiting Factor.

It is obvious to any one that in a series of complementary operations, each one dependent on the other, that the slowest of them determines the speed at which the whole can be accomplished. Translated into agricultural language, that is to say, if, in chaffcutting, the pitcher is slow and cannot keep up with the cutter, then the whole operation is delayed; the fault in the pitcher does not stop with him, but is automatically passed on to and affects the four or five other men as well. Almost every operation in farming is similar, but the picking out of the "limiting factor" or the "lazy pitcher" is not so easy, and, indeed, must sometimes be made the subject of careful study and test.

If the farmer will remember that on the farm every operation or set of operations is interlocking, and if he looks out for the slowest one in the series, and speeds it up, he will accomplish much towards the easy working and profit-earning capacity of his farm.

The examples quoted below are well known, but, looked at from the efficiency point of view, may serve to remind the farmer that in the humdrum press of daily work much of the profit is slipping through his fingers unobserved or, if observed, unchecked.

Foremost on the list is the care of horses and the making of them up into efficient teams. The horses are the farmer's fighting front, and he must personally supervise the feeding of them. No horse can regularly perform hard work if he is rushed into the stable by some lazy farm hand half-an-hour before bell-time. It will pay every farmer with hard work to do to feed oats to his horse. No desirable farm hand will stop long if he has to drive a team of underfed scrubbers. The only man that will stay under those conditions is a second-rater.

When there is hard work about, how many teams do we see free from sore shoulders; a sore shoulder, if not attended to at once, soon puts the horse out of action, and perhaps disorganizes the whole work. Whenever there is a sore shoulder there is a cause, and it is generally the collar; no amount of attention to the shoulder will avail unless the cause is removed.

Many farmers habitually work short of full horse strength; rather than buy a horse or two they will get along using smaller implements.

The more horses one man can work conveniently, the more economically is that man's labour utilized. This year, with the dearth of agricultural labour, it behoves every farmer to subject each farm operation to careful scrutiny, to see if horses, implements, efficiency, cannot make up for the lack of labour.

The overhauling of implements before the season starts, and the stocking of a reasonable supply of duplicates, may add another acre or two to the area ploughed. The provision of an adequate supply of chaff before the rush of work commences may mean 10 acres to your area, especially if all hands usually have to stop once a week to cut chaff.

Wage war on the saffron thistle, the charlock, the musk, and the wild oat. Wild oats uses up valuable moisture, and takes the place of good wheat. Saffron thistle, musk, and charlock mean loss of time and money at harvest. Last season was a particularly bad one for all these pests, and unless the fallows are well-worked after the weeds have germinated there may be dirty crops and, consequently, diminished yields.

THE KEEPING OF ACCURATE RECORDS AND THE EFFICIENCY REWARD.

The keeping of records and the payment for extra work done have been found to be a necessary part of any efficiency system. The records needed embrace the cost and the time of performance of the farm operations, and enable one to properly assess the value of the work performed.

The most serious problem that the farmer has to face to-day is the labour one. Each year it becomes increasingly difficult to obtain reliable men, and to retain them when found. It is idle to expect that you will get your farm hand to be a model of punctuality and efficient work, to expect him to eliminate every little slackness in the daily round, unless you reward him for his trouble. If you will pay him for the extra work done, and can stimulate a spirit of friendly competition among the workers in the field, you have done much towards increasing your returns.

. . . .

Summing up, then, we see that this season there is a golden opportunity to help the Empire, and, at the same time, receive adequate return for one's efforts. It, therefore, behoves the farmer to seriously consider all the ways and means of accelerating his production and supplement the good work that Australia has already done in this world-wide strife.

INCREASING PRIMARY PRODUCTION.

An Address delivered by Mr. A. E. V. Richardson, Agricultural Superintendent, at the Annual Conference of the Australian Natives Association, Kerang, 25th March.

At no time in history have the problems of food supply caused European countries more grave concern than at present. The Central Empires are on the verge of starvation, and the position in Allied and neutral countries is far from encouraging. Food is scarce, prices high, and the outlook is grave and uncertain.

WORLD SHORTAGE OF FOOD.

Several causes have contributed to bring about an abnormal shortage in supplies. The season of 1916 was a disastrous one for the Northern Hemisphere. Compared with 1915, which was a good year, the falling off in the six staple foodstuffs for man and beast—wheat, rye, oats, maize, barley, and potatoes—amounted to no less than 2,100,000,000 bushels, made up as follows:—Wheat, 832,000,000 bushels; maize, 596,000,000 bushels; oats, 404,000,000 bushels; potatoes, 224,000,000 bushels; and rye, 50,000,000 bushels.

Despite the attraction of high prices for foodstuffs, their production in Europe has not increased. Every nation at war has drawn on its able-bodied manhood to fill the fighting ranks, and every neutral country, attracted by the glamour of high wages and big profits in munition making, has rushed into the production of munitions.

The food shortage has been accentuated, too, by the ruthless German submarine campaign, whereby hundreds of thousands of tons of shipping, largely burdened with cereals and meat, have been sunk each month. Finally, during the recent Roumanian campaign, immense quantities of foodstuffs were destroyed in the disastrous retreat through Wallachia.

Evidence of the acuteness of the food position may be gathered from the almost daily references in the cables, and from the speeches of distinguished statesmen. In the French Chamber of Deputies last week it was stated that the shortage in the 1916 wheat crop of France was 130,000,000 bushels. If the whole of Australia's exportable surplus for 1916 could be transferred to France, it would barely make up the deficiency in the French crop.

The Position in England.

Again, the Chancellor of the Exchequer, Mr. Bonar Law, stated in the House of Commons a few days ago that the British Cabinet had informed the War Office and the Board of Agriculture that, so far as Britain was concerned, it now regarded the production of food supplies at Home as of more importance than the sending of additional men to the Army.

This is a remarkable confession of the inability of British agriculture to rise to the nation's requirements and supply the necessary foodstuffs.

In the early stages of the war the present Prime Minister stated that the war would be one of attrition, and would be won by the side possessing the most men, munitions, money, and foodstuffs. Britain has supplied the money and men, and, through peerless organization, she has supplied the munitions required for final victory. But, so far as agriculture is concerned, she has been unable to increase her Home production during the war, and has to rely on the Dominions and neutrals to make up her shortage.

The attention recently given by the Imperial Government to the development of Home production, and the guarantees of fixed minimum prices for foodstuffs for the next five years, and the numerous references by Cabinet Ministers to agricultural problems, appear to indicate a change of policy towards British agriculture.

State Aid to Agriculture.

Agriculture has hitherto been regarded in Britain as a sort of industrial step-child, with its needs subordinated to those of commerce and industry. Britain has preferred to import her food rather than produce it at Home. In this respect she has followed an entirely different policy from Germany.

Germany, on the other hand, recognised the danger of becoming over-industrial, and by her economic policy, her system of agricultural education, the technical improvements she has made in agriculture, and the widespread adoption of systems of co-operation and credit, she has stimulated her agriculture to such an extent that she is able, on an area two and a-half times that of Victoria, to feed a population of 68,000,000 people.

During the past 25 years German agriculture has made remarkable progress, while British agriculture has remained stationary, or has even

declined in volume. Had it not been for the extraordinary expansion of agriculture in Germany during the past 25 years, which was a natural result of Germany's economic policy, and her system of agricultural education, her food supplies would have been exhausted long before the end of the second year of war, and she would have been compelled to sue for peace.

BRITISH *v.* GERMAN AGRICULTURE.

Let us briefly contrast the progress of agriculture in Germany and Great Britain during the past 25 years. The following table shows the production of cereals and potatoes in Great Britain in 1888 and 1913, in millions of bushels:—

	1888. Million Bushels.	1913 Million Bushels.
Wheat	76	58
Oats	151	180
Barley	70	68
Rye	14	2
Potatoes	228	283
Total	539	591

Contrast this with production in Germany in the same period:—

	1888. Million Bushels	1913. Million Bushels.
Wheat	103	171
Oats	243	669
Barley	97	168
Rye	262	481
Potatoes	950	1,988
	1,755	3,497

While British production in these foodstuffs has remained practically stationary, German production has practically doubled.

This extra production has been secured, not by winning new lands to agriculture, but by increasing the efficiency of farming operations and increasing the yield per acre.

Twenty-five years ago the British farmer was unexcelled in his craft, and the average yield per acre of his crops was at least 50 per cent. higher than the German farmer. For the five years' period prior to the war, the German farmer secured higher average yields per acre in each of the cereals—wheat, barley, oats, and rye.

It may be said that the British farmer has concentrated his attention on live stock during the past quarter of a century, and that in the realm of animal husbandry at least Britain has kept pace with Germany. Let us examine the figures of live stock production in both countries in 1888 and 1913. These are presented in the table:—*

	Great Britain. 1888.	Great Britain. 1913.	Germany. 1888.	Germany. 1913.
Cattle	10,270,000	11,914,000	8,740,000	20,182,000
Horses ..	1,940,000	1,999,000	2,420,000	4,523,000
Sheep	28,940,000	28,967,000	14,750,000	5,803,000
Pigs	3,820,000	4,055,000	5,820,000	22,100,000

* Abstracted from statistics of the *Year Book of Agriculture*, U.S.A.

It will be seen that while in Great Britain the number of live stock has not shown any material increase in the last 25 years, Germany has shown the following increases:—

Cattle	..	.. 131 per cent. increase.
Horses	..	.. 87 per cent. increase.
Pigs	..	.. 279 per cent. increase.

though her production of sheep has fallen off 60 per cent.

In fact, the value of the increase in live stock in Germany in the 25 years was over £300,000,000, which increase is greater than the value of the whole of the live stock in Great Britain at the outbreak of war.

Finally, the test of efficiency of any system of agriculture is its man-carrying capacity per unit of area. What, then, is the relative man-carrying capacity of, say, a 100-acre German and British farm?

For every 100 acres of cultivated land in England the British farmer grows 15 tons of cereals, 11 tons of potatoes, 17½ tons of milk, 4 tons of meat, and a negligible quantity of sugar.

For each 100 acres of cultivated land in Germany the German farmer produces 35 tons of cereals, 55 tons of potatoes, 28½ tons of milk, 4¼ tons of meat, and 2½ tons of sugar.

Finally, the average 100-acre farm in England supports 40-45 people, whilst in Germany the same size farm supports no less than 70-73 persons.

Britain "Speed the Plough" and "Organize Agriculture."

The remarkable progress of German agriculture has been brought about by her economic policy, the efficient system of agricultural education, the technical improvements effected in agricultural methods, and the widespread adoption of systems of co-operation and credit.

The difference between the carrying capacity of the British and German farms is due to the extent to which the plough is used in Germany. The average German farm of 100 acres has 46 acres devoted to cereals, 9 acres to roots and legumes, 10½ acres to potatoes, 2½ acres in fruit, and only 32 acres in grass. In Britain, the average 100-acre farm has no less than 70 acres lying in grass, and only 30 acres devoted to crops.

The diagram on page 216 illustrates this point forcibly.

The first great essential for British progress, therefore, is a policy of "speed the plough," and the utilization for cropping purposes of those enormous areas now lying in grass. This will require more capital, more labour, and more equipment to be attracted to agriculture.

If the British public will stand behind its agriculture, and see that it does not suffer unduly from the competition of cheap land and foreign labour in foreign countries, the capital and equipment necessary for the extension of arable farming will be attracted to agriculture.

The recent utterances of British statesmen appear to indicate that a permanent change of policy towards agriculture in Britain is imminent.

The cultivated land of Great Britain is, on the whole, superior to Germany, and the climatic conditions are certainly more favorable for crop production. Britain's scheme of agricultural education is likely to prove effective, but it was commenced 20 years later than Germany's, and what it wants is time to grow.

If a change in the policy is effected, and the agricultural resources of the country are systematically organized, the British farmer may be

called upon to re-establish his former leadership in agriculture, and make the country less dependent on outside food supplies, and far less vulnerable to enemy attacks.

The Lesson to Australia.

The moral of the German development of agricultural resources is not likely to be lost on a body such as the Australian Natives Association. This island continent of Australia, with its 3,000,000 square miles of territory, is held by a mere handful of people—about one and a-half to the square mile.

Thanks to the sheltering care of the British flag, and the admitted might of the British Navy, we have been able to hold and develop this continent on our own lines. What changes may be effected in the policy of nations as a result of the present world conflagration we know not.

We should realize, though, that if we wish to hold this continent and shape its future policy, we must develop its resources, increase its population, and prove our right to hold it. The mineral wealth must be exploited, the pastoral and agricultural resources developed, and manufactures stimulated.

A liberal policy for the encouragement of mining, agriculture, and manufactures must, therefore, be adopted. I propose to confine my remarks solely to the agricultural and pastoral industries. For if these can be made to flourish, trade and manufacture will thrive, and the whole community will be prosperous.

Germany has shown how, on 133,000,000 acres of land (about two-thirds the size of New South Wales) it is possible to maintain and feed a population of 68,000,000 people, *i.e.*, more than two persons every 4 acres. Here, in Australia, our population is about two persons per 1,000 acres.

That we can immeasurably increase our agricultural production must be obvious. The settlement at Mildura is one shining example as to how it can be done. At Mildura a population of 6,000 souls makes a comfortable living from 12,000 acres of land. Along the Murray valley there is sufficient land and water (if conserved) to provide for 100 settlements such as Mildura.

We are approaching a critical period in our national history, and the need for the development of our agricultural resources was never more urgent.

The loan expenditure to finance Australia's share in the war is rapidly increasing, and with it the annual interest charges are mounting up. These increasing interest charges must be met by taxation. Every bag of wheat, bale of wool, box of butter, or carcass of meat we can export during the currency of the war assists our Allies, helps to lighten the burden of taxation, and drives a nail in the enemy's coffin.

Australia's expenditure during the first year of the war was £73,000,000, of which more than half represented loan expenditure. Last year the loan expenditure was in the neighbourhood of £50,000,000 sterling, and next year the amount will be even higher. The only way in which Australia can maintain her financial stability and remain solvent is to increase the output of exportable products—wool, meat, butter, and wheat. These products Australia can raise to perfection, and the allied nations can consume all we have to spare.

Unfortunately, our distance from the heart of Empire, and the scarcity of tonnage, makes transport extremely difficult.

Nevertheless, we cannot foresee what may happen in the Northern hemisphere this year. Another disastrous season would involve Europe in serious consequences, in which case, despite the transport difficulties, there would be an urgent call for the whole of Australia's surplus products.

It is Australia's duty to go right ahead, and produce foodstuffs to the limit of her capacity, even if portion of them have to be stored until transport difficulties are less acute.

The three great sources of wealth to Australia are the pastoral, dairying, and wheat industries.

The Pastoral Industry.

The strength of a chain is determined by the strength of the weakest link.

The number of sheep that can be permanently maintained in Australia will depend on the reserves of fodder available in the driest seasons.

By making ample reserves of fodder, conserving and developing the water resources, harnessing the rivers, and extending irrigation settlements, the loss of stock which has characterized the droughty seasons of the past can be mitigated, if not wholly prevented.

The stock-carrying capacity of the country could be immensely increased by adopting in the better rainfall districts the practice of growing fodder crops for feeding off with sheep, and by top-dressing the natural pastures. We know the immense value superphosphate has been to the wheat-growing industry. Since the introduction of superphosphate, the prosperity of the farming community has gone ahead by leaps and bounds.

When the top-dressing of pasture and grazing lands, especially in the moister districts of the State, becomes general, the stock-carrying capacity of these lands will be immensely increased. Experiments on the top-dressing of pastures, carried out by the Department for the past four years, show that the stock-carrying capacity of ordinary grazing land can be increased from 50 to 100 per cent. by the application of suitable combinations of phosphate and lime.

Our Australian soils are noted for their deficiency of phosphoric acid, and many Victorian soils, especially in Gippsland, are deficient in lime. Top-dressing of natural pastures with phosphates, or with phosphates and lime, is practised by an occasional land-owner. When the practice becomes general, a new era of prosperity for the grazier will be ushered in, and the numbers of stock maintained from year to year will be immensely increased.

Dairying.

The dairying industry suffered a severe set-back during 1914, when many valuable cattle were lost through shortage of fodder. Export values for dairy produce were never better than at present, and in view of the scarcity of freight it is highly desirable that our raw foods should be exported in the tabloid form of butter and cheese, in which form the freight charges are but a fraction of the total value of the produce.

In spite of the attractive export rates ruling for dairy produce, it is not possible to increase immediately, to any material extent, the number

of cattle. Several years must elapse before the herds can be brought ... to their pre-drought strength. In the meantime, every effort should be made to rear female stock for breeding purposes. The utmost efforts should be made to effect improvements in the milking herds of the State by careful breeding, rational feeding, and systematic weeding.

The creed of the dairyman should be "Breed, Feed, Weed." Breed from the best types of cattle. Select a sire from a pure-bred herd of recognised and tested milking capacity. Feed the cattle well—for, after all, the cow is but a milk factory transforming raw material—food—into milk. Feed was never so plentiful, and concentrates may be obtained at very low rates.

Weed the herd, *i.e.*, ascertain the quantity of butter fat produced by each individual cow for the year, and cull out those below the standard.

The systematic adoption of these three principles would raise the efficiency of our dairy herds by at least 50 per cent. At present the average milk yield per cow in Victoria is about 325 gallons per annum. Considering the favorable climatic conditions, this is a low average for Victoria; and organized efforts, on the lines indicated, might be expected to raise the average ultimately to 500 gallons.

The Wheat Industry.

Two years ago the Government made an appeal to the wheat-growers to put in a larger acreage. At the time the appeal was made the country was in a critical condition. The worst drought on record had been experienced. Crops had failed, dams were dry, stock were dying on all sides, and fodder was selling at famine rates. Despite the unfavorable circumstances, the farmers of the State responded with a record acreage, and no less than 4,000,000 acres were sown to wheat.

Last evening the Premier, Sir Alexander Peacock, made an appeal for increased wheat production. Imperial necessities and Australia's interests justify such an appeal.

I will briefly detail, in the limited time at my disposal, how such increased wheat production might be brought about. Obviously, two avenues lie open to the wheat-grower. He can either increase the acreage under crop or improve his average yield per acre by better farming.

There is much unused land in the Western District that could be utilized for share farming, and a considerable increase in acreage is possible throughout this district. Similarly, in the Goulburn Valley and the North-East there are large areas of land that are used for grazing which might be brought under the plough.

One great difficulty, of course, with regard to extension of area is the difficulty of securing sufficient labour; moreover, extra capital and equipment are necessary. But, in view of the certainty of payable prices for wheat for some years, there is a fine opportunity for capitalists in assisting the extension of arable farming. If some scheme could be devised whereby capitalists, share farmers, and large land-holders could be brought together, it would doubtless lead to a considerable increase in the acreage.

Nature seems to be working in the farmers' interests this season. We experienced the heaviest rainfall on record in 1916, and there are large reserves of moisture stored in the soil. With but a moderate rainfall in 1917 good crops may, therefore, be expected.

Then the minimum price of wheat has been guaranteed for next season.

Before the farmer sows an acre of wheat he knows in advance that the price of his wheat will be at least 4s. per bushel f.o.b. The farmer, therefore, is placed on a level with the manufacturer, for he now knows what his crop costs are, the minimum price of his produce, and he can therefore speed up production with confidence.

In the more favoured districts of the State, where the rainfall is ample, it is desirable to utilize every available acre of land. In the drier parts of the State the wheat-grower would do well to concentrate his efforts on the thorough preparation of the soil. Thorough cultivation is the foundation of successful and profitable wheat-growing.

We often see cases where certain growers regularly secure double and treble the average yield of their district. In some cases this is due to the fact that they have better soil than their neighbours, but in most cases their methods of cultivation are far more thorough. A barb-wire fence frequently separated the grower of a 30-bushel crop from the grower of a 10-bushel crop. If, by local co-operative effort, the careless farmer could be induced to adopt the methods of the best farmer of the district, a 50 per cent. improvement in crop yields would result.

Fallowing and thorough working of the fallows are essential to success in the drier districts. Every inch of water saved in the fallow means at least an extra bushel of wheat at harvest time. Other factors are—(1) Liberal use of phosphates; (2) regular crop rotation; (3) the use of carefully-graded and selected seed; and (4) the use of the largest and most efficient types of implements.

The liberal use of superphosphates, especially when used on well-worked land, will greatly stimulate production. A number of tests conducted by the Agricultural Department have conclusively demonstrated that farmers would find it profitable business to increase their manurial dressings by at least 25 per cent. above the quantities now generally used in their respective districts. Not only would the heavier dressings give a considerable increase in crop over the lighter dressings, but the indirect effect of heavier dressings in stimulating the grazing value of the pastures is much greater than the light dressings.

A well-known pastoral property of 14,000 acres, near Lismore, provides an interesting illustration of the effect of cultivation and manuring on the stock-carrying capacity of the holding. On this property the owner, prior to cultivation, never shore more than 14,000 sheep. Eight years ago he commenced wheat-growing, using, approximately, ¾ cwt. of superphosphate with each acre of wheat sown. Despite the fact that 5,000 acres of the estate are devoted to cultivation, the number of sheep kept on the property has been maintained, and this owner now shears over 14,000 sheep each year.

Regular crop rotation is essential for maintaining high wheat yields. Sheep should be associated with every wheat farm, and no wheat-grower can realize the fullest profit from his holding without a flock of sheep.

Wheat, grass, bare fallow is the rotation best suited to our Mallee conditions. This implies one-third of the farm under wheat, one-third devoted to grazing for sheep, and one-third in bare fallow for the next wheat crop. In the Wimmera, oats sown on the stubbles takes the place

of the pasture, and in many cases wheat, oats, pasture, bare fallow is a rotation commonly practised.

In the moister parts of the State, where the moisture is sufficient to dispense with bare fallowing, the growing of fodder crops for feeding down to sheep should be more widely practised. This will enable the farm to carry more stock, the soil fertility will be greatly improved, and better crops of wheat will be reaped. Systematic crop rotation, associated with lamb raising, brings many other advantages, and must be regarded as essential for profitable wheat-growing. The particular type of rotation followed, however, must be adapted to the climatic conditions of the district in which a farm is situated.

Finally, choice of the right varieties of seed, the careful grading of seed, and the systematic selection to increase its prolificacy are other essential factors. In these times of high wages, labour should be made as efficient as possible. It is good business to use the largest implements possible, so that the utmost value will be received for a day's labour. Twenty-hoe drills, multiple furrow ploughs, 8-ft. harvesters, &c., enable each unit to handle larger areas, and thereby lessen the cost of production.

The implements which now form a large portion of the capital of the farm should be kept at maximum efficiency by overhauling them at frequent intervals and replacing worn parts, and by keeping in stock some of the more important duplicates.

Irrigation.

As Victoria must look for future agricultural expansion in the direction of intensive culture rather than the multiplication of acreage, it follows that the extension of irrigation and the increase of water storages should be accelerated. Irrigated agriculture, with its certainty of control over soil and crop, has infinitely more possibilities than dry farming.

Irrigated agriculture at Mildura supports one person for each 2 acres of land cultivated. The Mildura settlement, as a dry farming area, would probably not support more than twenty families on the 12,000 acres devoted to irrigation.

When all the existing streams in Victoria are harnessed, at least 750,000 acres, possiby 1,000,000 acres, will be devoted to irrigation. The main factors for success in settling such an area are—the acquisition of suitable land at a reasonable price, settlers with suitable experience and capital, the building up of a systematic body of irrigation knowledge to guide the settlers to success, and adequate and stable markets for irrigation products.

Development of Smaller Industries.

Victoria offers, by reason of its soil and climate, and its comparatively dense settlement, good opportunities for the successful establishment of industries which have not yet secured a firm hold in Australia. In this connexion, flax, tobacco, and sugar beet may be mentioned. It is admitted that our soils are eminently suited for these products, but hitherto labour difficulties have been the chief cause of their non-success. Tariff adjustments, or the adoption of adequate bounses, are probably the best way to firmly establish these infant industries, as it has been

amply demonstrated that the soils and climate in various parts of Victoria are quite suitable for the growth of such crops to perfection.

General Increase in Efficiency.

A general increase in efficiency is urgently required in all branches of primary production. Our average wheat yield could certainly be raised to 20 bushels per acre in favorable seasons, and we could, at least, secure a 16-bushel average over a ten-year period if all the resources of production were fully and properly used.

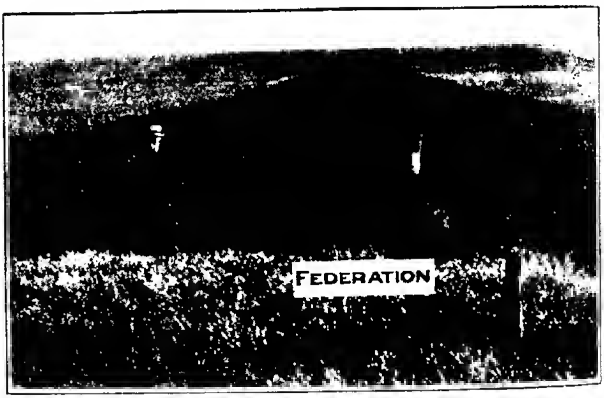
A change is gradually coming over our farming community, and finding expression in the desire for more technical knowledge, greater interest shown by farmers in experimental work, a keener appreciation of agricultural literature, and an eagerness to secure the most up-to-date and efficient farm implements.

Lack of capital is an important factor in retarding agricultural progress. The difference between the successful and unsuccessful wheat-grower is frequently due to the superior technical agricultural knowledge of the former, but is often due to the want of capital crippling enterprise on the part of the unsuccessful grower.

WHEAT EXPERIMENTS, SEASON 1916.

By A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

The past season has been remarkable for its heavy rainfall. Early in the season there were several consecutive dry months, but later an



Crop of Federation Wheat on Experimental Plot, at Cowangie, 1916, sown on a well-worked fallow. Yield, 41 bushels per acre.

unprecedentedly continuous downpour completely changed the aspect. From the Wimmera and Mallee Plots yields of over 40 bushels have

... obtained, but in the Northern and North-eastern districts there ... been an excess of rain, which in many cases has militated against ... returns.

Bearing in mind the season, the most striking results brought about by the year's work have been the value of heavier dressings of superphosphate than are normally used, and the promising appearance of certain of the new crossbreds raised on the experiment farms of the Department. The returns from the Mallee show that dressings of superphosphate up to 60 lb. per acre have this season given increasingly profitable returns, while at Warracknabeal and Longerenong dressings from 1½ cwt. to 2 cwt. per acre have shown the highest net profit per acre. At these places, however, it is probable that in normal years 1 cwt. per acre would show the highest net return.

Variety Wheat Trials.

The results from the five centres show several of the later maturing wheats to advantage, but at Longerenong and Warracknabeal Federation more than held its own. A striking feature of the returns was the excellent performance of several of the new crossbreds originated by this Department. These crossbreds will be again tested this season on the State farms, and if the yields are satisfactory, will then be made available for distribution.

One new variety, Major, produced by Mr. Pye at Dookie College, has done well in the tests. It is a late maturing variety, and should be particularly suitable for the cooler districts of the State.

On Government farms the tests show that the difference in the yields of a number of varieties sown under the same soil conditions is more than sufficient to pay rent and interest on the land on which the crop is grown. The farmer should, therefore, select such types as are suited to his district, and endeavour to keep the varieties productive by systematic selection.

Experiments conducted over the past five years have demonstrated that the yield of any variety may be improved by at least 15-20 per cent. by systematic seed selection.

Following are the results of the various tests:—

Seed, 60 lb. Super, 1 cwt.

WYUNA FARM.

	bushels.
New crossbred (Indian H. x comeback)	37.7
Yandilla King	36.1
Major	36.1
New crossbred (Stanley x Yandilla King)	34.8
New crossbred (Bobs x Federation)	34.3
Marshall's No. 3	33.9
Federation	30.2
Dart's Imperial	28.6
Commonwealth	28.5
Penny	28.0
Warden	25.9
King's Early	Badly lodged.

Rutherglen Farm.

	Bushels.
New crossbred (Clubhead x Yandilla King)	20.1
Marshall's No. 3	18.3
Major	17.5
New crossbred (4)	17.3
New crossbred (Indian H. x Comeback)	16.8
Penny	16.6
Dart's Imperial	16.6
Warden	15.0
Yandilla King	15.0
Federation	14.6
Zealand Blue	14.5
Comeback	14.0
Gluyas	13.6
College Eclipse	11.0
Commonwealth	10.6

Experimental Plots on Stubble Land at Ouyen, 1916. Yield, 22 bushels per acre.

Longerenong Farm.

	Bushels.
New crossbred (Red Skin x Yandilla King)	44.5
Selected Federation	43.4
Federation	41.3
New crossbred (Clubhead x Yandilla King)	39.5
Yandilla King	39.0
Major	36.6
New crossbred (Bobs x Federation)	36.16
College Eclipse	35.5
Dart's Imperial	35.1
New crossbred (Stanley x Yandilla King)	34.4
Purple Straw	28.3
Bunyip	24.4
Currawa	22.2

Plots at Wyuna were sown on well-worked fallow on 23rd May, 1916, and all received uniform allowances of seed and manure. At Rutherglen, the winter rainfall was the highest on record, no less than 24.36 inches falling during the growing period of the crop. The crops made remarkably good early growth, but the saturated state of the soil throughout the spring months prevented high yields being obtained. At Longerenong, the rainfall was better distributed throughout the season, and the yields were relatively higher than at other centres.

Variety Trials in the Mallee.

Ten different varieties were sown at each centre; five were early wheats, and five late varieties. The plots were 1½—2 acres each in area, and were sown with 60 lb. of superphosphate and 45 lb. of graded

An Outpost of Wheat-growing in Victoria.

The value of phosphates at Carwarp, 1917. Crop on the right unmanured, yield, 7 bushels 29 lbs. On the left 60 lbs. super. per acre, yield, 19 bushels 40 lbs. Crop sown on stubble land.

seed per acre. Both at Carwarp and Ouyen, the plots were sown on stubble land, whilst at Cowangie they were sown on fallowed land.

The results of the Carwarp tests were as follows:—

	Bush.	lb.
Dart's Imperial	19	8
Yandilla King	18	28
Currawa	18	24
Penny	17	16
Federation	16	25
Gluyas	16	19
Thew	16	4
College Eclipse	15	17
Bunyip	15	6
King's Early	14	9

The trials were conducted on the farm of Mr. P. J. Stewart. The results of the test show that early-maturing varieties of wheat, which in dry seasons do particularly well in the Mallee country, gave much

lower returns than the late maturing types this season. This is to be expected in such a season as the present, for the prolonged cool and rainy weather in spring and summer favours the development of the slow-growing types. At Ouyen and Cowangie, the early wheats made excellent early growth, but the late season proved unfavorable for their development. At Ouyen, the plots were carried out on the farm of Cr. H. W. Pickering, on land that had been in crop four years in succession. The results of the variety plots were as follows:—

	Bush.	lb.
Dart's Imperial	28	33
Yandilla King	26	15
Federation	24	8
Currawa	22	27
Penny	21	19

At Cowangie, plots were conducted by Cr. H. F. Hecht, on land that had been fallowed the previous year. The results were as follows:—

	Bush.	lb.
Federation	41	10
Penny	31	5
Dart's Imperial	29	11
Currawa	27	20
College Eclipse	26	53
Yandilla King	25	42

The average yields of all the three centres were as follows:—

	Bush.	lb.
Federation	27	11
Dart's Imperial	25	37
Yandilla King	23	28
Penny	23	13
Currawa	22	14

The three varieties, Federation, Dart's Imperial, and Yandilla King, were the best yielding varieties in the experimental plots last season. In all cases, the yields for 1916 are considerably above those of the previous year, and above what was expected two months ago.

Warracknabeal Plots.

At Mr. G. C. Coutts' farm, Batchica. Plots sown 17th July, 1916. Harvested 3rd January, 1917. Super., 1 cwt.; Seed, 6 lbs.

	Bushels.
1. Penny	46.0
2. Bayah ..	45.9
3. Federation	45.6
4. College Eclipse ..	44.5
5. Currawa	41.0
6. Commonwealth	40.4
7. Avoca	40.1
8. Major	40.0
9. Marquis	38.2
10. Marshalls (3) ..	37.0
11. Huguenot	30.1

MANURIAL TRIALS.

The following are details of the manurial trials at Warracknabeal, located on Mr. Coutts' farm at Batchica:—

	Bushels:
1. No manure..	35.3
2. ½ cwt. of superphosphate	41.8
3. 1 cwt. of superphosphate	44.8
4. 1½ cwt. of superphosphate	48.7
5. 1 cwt. super., ½ cwt. basic slag	45.9
6. 1 cwt. basic slag	42.8
7. 1 cwt. super., lime 10 cwt. (1912)	44.7
8. 1 cwt. super., 40 lbs. N. soda .. .	43.0
9. 1 cwt. super., 40 lbs. N. soda, 40 lbs. Pot. sulp.	43.2

The highest net profit has been obtained with the use of superphosphate by itself. Taking wheat at current prices, a steady increase is shown from dressings of 1½ cwt. per acre up to 1½ cwt. per acre—the maximum amount tried. With ½ cwt. super. an increase of 23s. 6d. per acre was returned after deducting the cost of the manure, while with 1½ cwt. per acre it was no less than 40s.

The mixed manures were also responsible for high yields, but the net returns were not so high. At Longerenong the returns were available over a longer period, and show perhaps a truer indication as to the relative values of the manures.

MANURIAL TRIALS AT LONGERENONG.

Each plot was sown with graded Federation seed on the 24th June at the uniform rate of 63 lb. per acre. The cultivation of each plot was identical, but the manurial dressings were different. The results for the seasons 1913 and 1916, together with the average yield of each of the thirteen plots for the past four seasons, are as follow:—

Treatment (per acre.)	Yield per Acre. 1913.	Yield per Acre. 1916.	Average for 4 Years.
	Bushels.	Bushels.	Bushels.
No manure	17 41	33·45	22·83
Super., 56 lbs.	25·66	35·7	28·97
Super., 1 cwt.	29 16	36·0	39·58
Super., 2 cwt.	29·66	39 2	32·42
Super., 1 cwt.; lime, 5 cwt.	29·40	36·8	31·2
Super., 1 cwt.; lime, 10 cwt	29.83	37·4	31·04
Super., 1 cwt.; nitrate of soda, 40 lbs.	30·66	38·5	32·12
Thomas phosphate, 1 cwt.	18·83	38·5	25·7
Super., 1 cwt.; nitrate of soda, 40 lbs.; sulphate of potash, 40 lbs	30 00	38·6	30·98
Super., ½ cwt.; Thomas phosphate, ½ cwt.	27·66	37·6	29·43
Super., 1 cwt.; nitrate of soda, 40 lbs., top dressing in spring	34 33	36·4	31·67
Farm-yard manure, 10 tons	24·83	45·7	30·16

Rainfall during growing period (May–November), 1913, 11·72 inches; 1916, 18·18 inches.

Taking the average for the four-year period, which included the drought year, the average return from the no-manure plot was 22.83 bushels. The land is sufficiently fertile to yield by good cultivation and bare fallow alone nearly 23 bushels per acre. The application of ½ cwt. of phosphates in the form of super. raised the yield to 28.97 bushels—An increase of 6.16 bushels, worth at 4s. per bushel, 24s. 6d. per acre, thus showing a net profit of 22s. per acre. This increase in yield was obtained by the expenditure of 2s. 6d. per acre for fertilizer.

Superphosphates applied at the rate of 1 cwt. per acre at a cost of 5s. per acre, gave an increase over the unmanured plot of 7¾ bushels, worth 31s. per acre, leaving a net profit of 26s. per acre. The 2 cwt. application costing 10s. per acre, gave an increase of 9.62 bushels per acre over the unmanured plot, representing a net profit of 28s. 6d. per acre.

Last year the application of 10 tons of farmyard manure per acre gave a yield of 6½ bushels per acre more than any combination of artificial manure. This was to be expected in a cool, wet season. The average return over a four-year period, however, is approximately the same as that from a dressing of 1 cwt. of superphosphate.

These returns show that wheat yields in the Wimmera may be maintained at a high level by bare fallowing, judicious cultivation and the liberal use of phosphates.

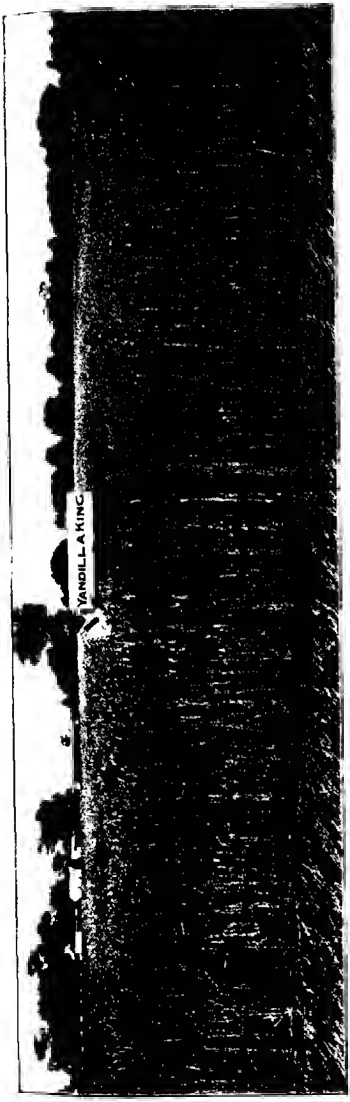
Manurial Trials in the Mallee.

The Department of Agriculture for the past three years has conducted variety and manurial wheat tests at Ouyen and Cowangie to determine the most suitable of wheat and manure for these areas. This year Carwarp was included in the tests. The results of the 1916 test demonstrate the fertility of these mallee areas when favorable climatic conditions are combined with good farming. The manurial tests consisted of trials of no manure against heavy and light dressings of superphosphates sown in plots of 1 to 2 acres each in area.

The results of the 1916 tests were as follow:—

Quantity per acre.	Carwarp		Cowangie.		Ouyen.		Average of all centres	
	Bush	lbs.	Bush.	lbs.	Bush.	lbs.	Bush.	lbs.
No manure ..	7	29	37	42	24	10	26	27
30 lbs. super. ..	16	59	44	31	25	49	29	6
60 lbs. super. ..	19	40	45	34	25	57	30	24
90 lbs. super. ..	21	58	45	52	24	5	30	39

The most striking differences were observed at Carwarp, where the soil was of a light sandy character. Here the application of 30 lbs. of superphosphate, costing 1s. 3d. per acre, gave an increase of 9½ bushels in the yield, worth in normal times £1 11s. 8d. per acre. The application of 60 lbs. resulted in an increase over the unmanured plot of 12 bushels 11 lbs.; whilst the 90 lb. dressing gave an increase of 14 bushels 2 lbs. per acre, worth £2 8s. 4d. per acre, gained at a cost of 4s. 6d. per acre.

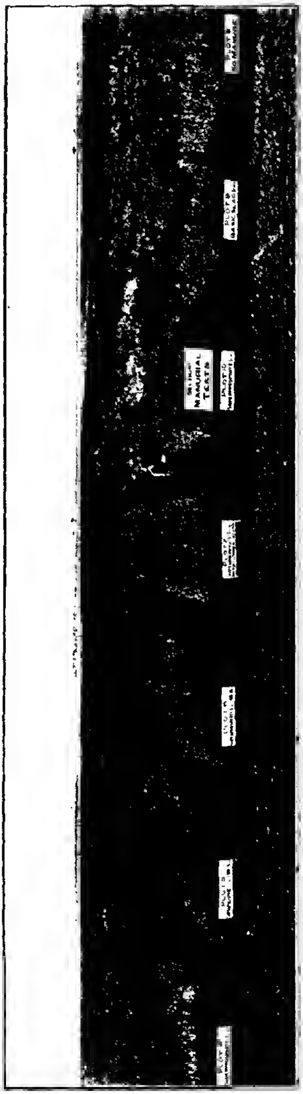


Yandilla King, on Wyuna Experimental Plots, 1916. Yield, 36.4 bushels.

Mr. P. J. Stewart, the experimenter at Carwarp, writes: — "The contrast in the unmanured and manured plots was most striking, both in appearance and in the yield, and proves that sowing wheat without manure in light soils is a waste of time, labour and money."

These tests were made on new land. At Ouyen the tests were carried out on rich pine country, which had been cropped for four years in succession. The application of 30 lbs. of super. gave an increase of 1½ bushels per acre, but the heavier dressings gave no substantial increase in yield.

At Cowangie the plots were sown on land which had been specially fallowed with selected Federation seed, and gave phenomenal returns, the unmanured plot giving no less than 37 bushels 42 lbs. per acre. The plot dressed with 30 lbs. super. gave 44 bushels 31 lbs., an increase of 6 bushels 49 lbs. per acre, worth at normal prices £1 3s. per acre. The plot dressed with 60 lbs. super. per acre returned 45 bushels 34 lbs., an increase of 7 bushels 53 lbs. Taking the average of all centres, the most profitable dressing to apply in in such a season as the present is 60 lbs. per acre. Taking the yields as a whole, they afford remarkable testimony of the fertility of mallee



Permanent Manurial Tests at Longerenong Agricultural College: Dooen, 1917.

lands. Only at one centre were the plots sown on fallowed land, and here the average yield of the four plots was 43 bushels per acre. The season was very favorable for wheat-growing, the rainfall being 3 to 4 inches above the average. The average rainfall of these areas is low, but it is quite sufficient, provided proper tillage methods are followed, to render wheat-growing safe and profitable.

When the systematic farming methods characteristic of the older settled districts are applied to these new areas, their average yields will increase by at least 50 per cent. Bare fallowing to conserve moisture is an absolute essential for good crops in these districts, yet only 1 acre in 10 was sown on fallowed land in 1916. On the other hand in the Wimmera, where fallowing is less necessary than in the Mallee, there is only 1 acre of wheat in 10 not sown on fallowed land. Only in very isolated instances were sheep to be found in these newer mallee areas. As farming methods improve, the association of small flocks of sheep with wheat-growing will be essential, and will open up another avenue of profit to the mallee grower.

LECTURES, FARMERS' CLASSES, AND STALLION PARADES.

The following letter has been addressed to the secretaries of all Agricultural Societies throughout the State by the Director of Agriculture, Dr S. S. Cameron:—

I have the honor, by direction, to inform you that the Department's arrangements for the holding of stallion parades, lectures, and farmers' classes during 1917 are as under:—

STALLION PARADES.

A somewhat curtailed time table for stallion parades is being arranged, and will be forwarded to you shortly, so that the necessary local arrangements may be made as usual. It is desired that the system confining the award of prizes to certified stallions only shall be continued, in order that societies may obtain the benefit of the subsidy when it is resumed.

LECTURES.

Enclosed is a list of lectures and demonstrations which will be given on request from Agricultural Societies and kindred bodies during 1917.

On account of the shortage in the staff through enlistment, no lectures on veterinary subjects can be given, but the whole programme on other subjects can be arranged, and the Department will be glad to comply with the requests of societies as far as possible.

It is suggested, in order to save the time of officers, and travelling expenses, that societies requiring the usual four lectures should arrange that at least two should be held at centres in the same district on two following dates, or as near one another as practicable.

FARMERS' CLASSES.

It has been decided to shorten the period for farmers' classes from a fortnight to a week, in order to lessen the inconvenience to farmers, farmers' sons, and others, and thereby promote larger attendances. It will also be possible, under this arrangement, to meet the applications of a larger number of districts.

STALLION PARADES.

The awards of prizes in all classes for stallions three years old and over at the Society's Show, to be subject to the possession by the exhibit of a Government certificate of soundness.

Stallion Inspection Parades will be held at different centres throughout the State prior to the commencement of the Show season (Time-table for Stallion Parades for 1917 will be available shortly after 1st May, 1917). The parade centres are so arranged that all owners of Show stallions have the opportunity of submitting them for examination for the Government certificate of soundness before the closing of entries for the Show. Show secretaries will require to obtain evidence of the possession of the Government certificate in respect of exhibits at the time of entry, and should not accept entries of other than certificated horses.

Immediately after the Show, secretaries of societies are required to forward the names *of all the horses* that have won the prizes in stallion classes, together with the names of the owners, to the Director of Agriculture.

FARMERS' CLASSES.

Applications should be submitted as early as possible. Twenty students at least must be enrolled before a class can be held.

The rent of hall and all local charges are to be paid by the Society; all other expenses by the Department. Arrangements must be made to insure the uninterrupted use of the hall during the time the lectures are going on.

A roll of attendances at lectures and demonstrations shall be kept.

The Agricultural Classes will extend over one week, consisting of not more than five evening lectures. Field demonstrations will be arranged for day-time instruction on days as required. The majority of the lectures will be illustrated by limelight views.

Examinations will be held at the conclusion of each class, provided not less than five students compete. The successful competitor at each class will be eligible to take part in a final examination for the A.N.A. gold medal in Melbourne.

Free rail tickets will be issued to students to attend this final examination. Five competitors or more must attend or no medal will be awarded.

Professional men, students in attendance at Agricultural High Schools and Colleges, or at the Continuation Schools, and teachers from such institutions or State schools, are not allowed to sit for the examination.

LECTURES.

Applications should be submitted as early as possible, and accompanying the application must be a list of the subjects which the Society chooses. The dates of lectures or classes will then be fixed by the Department, and if Societies will state the most suitable seasons for their districts the classes or lectures will, as far as possible, be arranged accordingly.

The president or secretary, or a member of the council or committee of the Society, must take the chair at each lecture or class, and must certify as to the number and *bona fides* of the attendance as above required.

The rent of the hall, advertising, and all other local charges are to be paid by the Society; all other expenses by the Department.

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GOVERNMENT CERTIFICATION OF STALLIONS.

TENTH ANNUAL REPORT (SEASON 1916) ON THE VETERINARY EXAMINATION OF STALLIONS FOR GOVERNMENT CERTIFICATE OF SOUNDNESS AND APPROVAL.

By W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer.

With the hearty co-operation of all interested in the system of Government certification of stallions, the tenth year of the examinations has been brought to a successful conclusion. I have again to record my appreciation of the assistance rendered; by owners of stallions who accepted the time-table as arranged, often at some considerable inconvenience to themselves, and by secretaries of agricultural societies, upon whom devolved the duty of arranging for stallions to be in attendance promptly at the advertised hour, and, in those cases where no horses were coming forward for examination, by notifying me in sufficient time to allow of cancellation, so conserving the time of the examining officer, and in this way reducing the number of parades to 89. Finally, by the two veterinary officers, Messrs. Griffin and Lerew, who overcame every obstacle, such as cancellation of trains, &c., and kept all appointments made. Involving as this did, the holding of two, three, and even four parades a day, and as many as nine and eleven parades a week, it will be recognised how a breakdown in the engagements would have disorganized the time-table. The number of examinations and action taken by each of the veterinary officers is as shown hereunder:—

Officer.	Number Examined.	Number Certificated.	Number Rejected.	Per centage Rejected.
Mr. R. Griffin, M.R.C.V.S.	134	82	52	38·80
Mr. W. M. Lerew, G.M.V.C. ...	178	101	77	43·26
Appeal Boards	8	2	6	75·00

A most gratifying feature of the past season was found in the fact that in spite of the Government grant to agricultural societies being suspended, and consequently the compulsory condition not having to be complied with, the enthusiasm in the scheme did not abate and the spirit underlying its introduction was faithfully carried out in a continuation of the policy that only certificated stallions could be awarded a prize at agricultural shows. This clearly indicates that the majority of breeders are in hearty accord with the desire to eliminate from our studs all unsound and nondescript sires, and this contention is further supported by the desire so freely expressed to obtain legislative control and to introduce a system of registration. It is earnestly hoped that time will be found during the next session of Parliament to place the Bill—which, as already notified in the press, has been drafted—upon the statute-book.

EXAMINATIONS AND REJECTIONS.

Unsoundness.

The number of horses examined was 320, being 35 less than during the previous season. The rejections show a slight decrease under the heading of "Unsoundness" and an increase for "Disapproval," the figures being 11.25 per cent. unsound and 30.94 below standard as against 14.93 and 23.1, respectively, for 1915-16, whilst the total rejections were 42.19 per cent. as against 38.03 per cent. for the previous years. An examination of tables during the past ten years shows the following as the rejections each year for unsoundness:—

1907/8.	1908/9.	1909/10.	1910/11.	1911/12.	1912/13.	1913/14.	1914/15.	1915/16.	1916/17.
15·04	17·17	15·04	17·09	10·42	11·59	10·38	13·76	14·93	11·25

At first sight this does not appear so encouraging as a closer investigation warrants, for, as pointed out in a previous report, though in light horses and ponies little unsoundness is found, the number of such examined very considerably changes the ratio of unsoundness discovered, and last year there was a higher proportion of these breeds examined than usual.

A far better index of the value of the examination is to take only that breed in which unsoundness is prevalent, namely, the draughts, and for the past ten years the figures run as follow:—

1907/8.	1908/9.	1909/10.	1910/11.	1911/12	1912/13.	1913/14.	1914/15.	1915/16.	1916/17.
23·82	27·33	23·52	21·57	12·13	12·03	11·0	15·5	19·67	16·49

If we divide the period into two of five years each, in order to eliminate the fluctuations which occur from season to season, we see that for the first five years an average of 20.8 per cent. was rejected, and in the second an average of 13.4 per cent.—a difference of 7.4 per cent., or a decrease of 35 per cent. Such figures cannot be regarded as other than highly satisfactory, and indicate that the elimination of unsoundness has commenced. A higher percentage could not be expected, especially when it is borne in mind that uncertificated stallions have not been wholly removed from breeding operations, and that not more than two generations have been dealt with. Should legislation which would prevent such stallions being used for stud purposes ever be passed, there should be a much greater reduction of unsoundness detected.

Disapproval.

With regard to refusal of certificates for "disapproval"—as it is termed for convenience—and which indicates the horse as being below a reasonable standard in respect of breed type and conformation, the percentage of rejections has progressively increased, as the following figures show:—

1907/8.	1908/9.	1909/10.	1910/11.	1911/12.	1912/13.	1913/14.	1914/15.	1915/16.	1916/17.
8·58	8·24	14·65	9·6	12·15	10·27	20·14	20·4	23·1	30·9

This must not be taken to indicate that the horses of the present day are not as good as they were ten years ago; during the early years only those horses absolutely of low type were refused, whilst of later years there has been a desire to require a higher and higher standard, which is supported by breeders, who so frequently have passed the remark: "There are too many certificates issued." Yet the average type present in Victoria is to-day far superior to that seen when the first examinations were conducted.

As further evidence of the support of breeders under this head, and also of the judgment of veterinary officers, it is worthy of note that only five appeals were lodged against refusal of certificates for disapproval, and that the Appeal Boards upheld the action in four cases and reversed the decision in only one.

The accompanying table shows an analysis of the examinations made during the last season:—

	Draughts.		Lights.		Ponies.		Totals.	
—	Examined.	Certificated.	Examined.	Certificated.	Examined.	Certificated.	Examined.	Certificated.
	188	116	79	40	53	29	320	185
	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.
Bog Spavin ...	...	...	...	...	...	...	...	...
Bone Spavin	...	...	2	1·07	2	3·77	4	·94
Cataract ...	...	...	...	...	...	...	...	...
Chorea	...	...	...	...	...	...	...	...
Curb ...	...	...	...	...	...	...	...	...
Navicular Disease	...	...	...	...	...	...	...	...
Nasal Disease	...	...	...	...	...	...	...	...
Ringbone ...	7	3·72	1	1.27	...	...	8	2.50
Roaring ...	2	1·06	...	...	...	...	2	·62
Sidebone ...	22	11·70	...	...	...	...	22	6·88
Stringhalt ...	...	...	...	...	...	...	...	...
Thoroughpin	...	...	...	...	...	...	...	...
Whistling ...	...	...	...	...	...	...	...	...
Total unsoundness	31	16·49	3	3·80	2	3·77	36	11·25
Disapproved	41	21·81	36	45·57	22	41·51	99	30·94
Total rejected	72	38·30	39	49·37	24	45·28	135	42·19

As in previous years, sidebone in the draught horse is responsible for the majority of the rejections, and this shows a falling from 16.32 to 11.70—a difference of 4.6 per cent. None of the other unsoundnesses call for special comment.

The number of stallions submitted for re-examination is shown hereunder:—

HORSES SUBMITTED FOR RENEWAL OF CERTIFICATES, 1916-1917.

Reason for Rejection.	3 years.		4 years.		5 years.		Totals.	
	Examined. 4	Certificated. 3	Examined. 36	Certificated. 27	Examined. 72	Certificated. 45	Examined. 112	Certificated. 75
	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.	Rejected.	Per cent. Rejected.
Disapproval	1	25	5	13·89	16	22·22	22	19·64
Sidebone ..	..	..	2	5·55	8	11·11	10	8·93
Ringbone ..	..	..	2	5·55	2	2·78	4	3·57
Curb ..	..	..	..	..	..	..	..	..
Spavin ..	..	..	..	..	..	..	..	..
Roaring ..	..	..	..	..	1	1·39	1	·89
Cataract ..	..	..	..	..	..	..	..	..
	1	25	9	25	27	37·50	37	33·03

These figures—although it must be noted the total examined is small and consequently averages are liable to greater fluctuation—support the contention that the result of the certification is being shown in the rising generation, for there is a fall of the percentage rejections in sidebone of 4.1 per cent. in four-year-olds, and 2.7 per cent. in five-year-olds, which had previously been examined, over the result of the previous year's operations.

TRANSFERRED CERTIFICATES.

The number of certificates presented for transfer for Victorian Government certificates is as follows:—

New Zealand	39
New South Wales	6
Tasmania	3
South Australia	2
	50

whilst three certificates issued in New South Wales have been indorsed for recognition at Victorian shows.

Appeals.

The number of appeals lodged was eight. As already indicated, five of these were on the ground of disapproval and one only was upheld; whilst three were on the question of unsoundness, and in two of these the opinion of the examining officers were upheld.

Additional Regulation.

Some stallion owners become on occasion somewhat neglectful in the care of certificates issued to them—such certificates being frequently mislaid or lost. It has therefore been provided by Regulation 9 of Part III. that for the future a duplicate copy will be issued on receipt of satisfactory evidence supported by statutory declaration that such certificate has been so lost—the fee to be charged for such duplicate is £1 1s.

Arrangements for Coming Year.

For the coming year a time-table has been arranged on almost similar basis to that operated upon last season. There being only two officers available, it is earnestly hoped that the consideration extended last year will be again shown, and the time-table will be strictly observed. A careful study will show how arrangements could be disorganized by alteration of either time or date of parade.

Examination of Mares.

Since the compilation of this report it has been decided to introduce the system of examination and certification of mares. For the first year, however, only those mares which are registered in a recognised stud-book for draught horses will be examined, and then only at parades as advertised for the examination of stallions, and provided the Veterinary Officer has time to conduct such examination without interfering with the time-table. All examinations will be conducted under the same regulations as those controlling the examination of stallions.

SUMMARY OF TEN YEARS' WORK, 1907–1916.

Season.	Draughts. Examined.	Draughts. Certificated.	Draughts. Rejected.		Draughts. Percentage.	Lights. Examined.	Lights. Certificated.	Lights. Rejected.		Lights. Percentage.	Ponies. Examined.	Ponies. Certificated.	Ponies. Rejected.		Ponies. Percentage.	Totals. Examined.	Totals. Certificated.	Totals. Rejected.		Totals. Percentage.
1907–8 ..	403	271	Unsound	96	23·82	301	246	Unsound	32	10·63	214	186	Unsound	10	4·67	918	703	Unsound ..	138	15·04
			Disapproved	38	8·93			Disapproved	23	7·64			Disapproved	18	8·41			Disapproved	77	8·38
				132	32·75				55	18·27				28	13·08				215	23·42
1908–9 ..	501	341	Unsound	137	27·33	295	242	Unsound	29	9·83	199	159	Unsound	5	2·5	995	742	Unsound ..	171	17·17
			Disapproved	23	4·59			Disapproved	24	8·13			Disapproved	35	17·58			Disapproved	82	8·24
				180	31·92				53	17·96				40	20·10				253	25·41
1909–10 ..	410	275	Unsound	98	23·52	191	147	Unsound	12	6·27	156	112	Unsound	5	3·29	757	534	Unsound ..	118	15·04
			Disapproved	39	9·56			Disapproved	32	16·77			Disapproved	39	25·65			Disapproved	110	14·65
				135	33·08				44	23·04				44	28·94				228	29·69
1910–11 ..	542	387	Unsound	117	21·57	143	108	Unsound	15	10·53	128	101	Unsound	7	5·47	813	598	Unsound ..	139	17·09
			Disapproved	38	7·01			Disapproved	20	14·08			Disapproved	20	15·62			Disapproved	78	9·6
				155	28·58				35	24·61				27	21·09				217	26·69
1911–12 ..	692	554	Unsound	84	12·13	165	120	Unsound	13	7·87	122	83	Unsound	5	4·09	979	758	Unsound ..	102	10·42
			Disapproved	54	7·8			Disapproved	31	18·78			Disapproved	34	27·88			Disapproved	119	12·15
				138	19·94				44	26·66				39	31·96				221	22·57
1912–13 ..	745	597	Unsound	89	12·03	139	106	Unsound	19	13·67	70	43	Unsound	2	2·85	954	746	Unsound ..	110	11·59
			Disapproved	59	7·92			Disapproved	14	10·07			Disapproved	25	35·71			Disapproved	98	10·27
				148	10·73				33	23·74				27	38·57				208	21·81
1913–14 ..	718	507	Unsound	79	11·0	157	102	Unsound	16	10·19	88	60	Unsound	5	5·68	963	669	Unsound	100	10·38
			Disapproved	132	18·38			Disapproved	39	24·84			Disapproved	23	26·14			Disapproved	194	20·14
				211	29·39				55	35·03				28	31·82				294	30·53
1914–15 ..	400	287	Unsound	62	15·50	121	75	Unsound	14	11·57	82	55	Unsound	7	8·53	603	397	Unsound ..	83	13·76
			Disapproved	71	17·75			Disapproved	32	26·44			Disapproved	20	24·39			Disapproved	123	20·40
				133	33·25				46	38·01				27	32·92				206	34·16
1915–16 ..	239	144	Unsound	47	19·67	71	48	Unsound	5	7·04	45	28	Unsound	1	2·22	355	220	Unsound	53	14·93
			Disapproved	48	20·08			Disapproved	18	25·35			Disapproved	16	35·55			Disapproved	82	23·10
				95	39·75				23	32·39				17	37·77				135	38·03
1916–17 ..	188	106	Unsound	31	16·49	79	40	Unsound	3	3·80	53	29	Unsound	2	3·77	320	185	Unsound	36	11·25
			Disapproved	41	21·81			Disapproved	36	45·67			Disapproved	22	41·51			Disapproved	99	30·94
				[illegible]	[illegible]				[illegible]	[illegible]				24	45·28				135	42·19

REGULATIONS

GOVERNING THE EXAMINATION OF STALLIONS AND MARES FOR THE GOVERNMENT CERTIFICATE OF SOUNDNESS AND APPROVAL.

I.—EXAMINATION PARADES.

(1) Societies within whose district an Inspection Parade is appointed are required to provide a suitable place for the examinations to be conducted, and to suitably and reasonably advertise the holding of the parade on receipt of notice from the Department of the fixture. The secretary or some member of the committee of the society is required to be in attendance at the appointed time to assist the examining officer in the arrangements for the inspection.

(2) The Parades will be conducted and the Veterinary Officer will attend without expense to Societies other than that involved in advertising and making known the occasion to the public and the horse-owners in the district, and providing the examination ground.

(3) The Examining Officer will attend Inspection Parades held at times and places set out in the official Time Table for the year, and all examinations for the Government Certificate will be made at such Parades or on some such publicly advertised occasion, *unless* under special circumstances as provided for in clause 5.

(4) In the event of it being found impossible for local reasons to hold the Parade in any district at the time and date set out in the Time Table, notice to that effect—together with suggestions for alternative date and time compatible with the rest of the Time Table—should be given *not later than 1st June,* after which no alteration in the Time Table can be made.

(5) The special examination of horses for the Government Certificate of Soundness at other than the advertised parades may be arranged for in cases where, through accidental circumstances, the owner has failed to submit the horse at such parade.

Such examinations will only be arranged when the attendance of the Examining Officer will not interfere with the requirements of the Department for his services in other directions.

An owner requesting such special examinations will be required to prepay a fee of £1 1s. for each horse examined; also the railway fare (first class return), and travelling expenses at the rate of 14s. per day, of the visiting officer.

II.—GROUNDS FOR REJECTION.

(1) Refusal of Certificate on the ground of unsoundness will be made only when, in the opinion of the Examining Officer, the horse is affected at the time of examination with one or more of the following hereditary unsoundnesses, viz.:—

Bog Spavin	Ringbone
Bone Spavin	Roaring
Cataract	Sidebone
Chorea "Shivering" or "Nervy"	Stringhalt
Curb	Thoroughpin
Navicular disease	Whistling
Nasal disease (Osteo-porosis)	

or such other hereditary unsoundness as the Minister may at any time declare. (Blemishes or unsoundness the result—in the opinion of

the Examining Officer on appearances then presented—of accident, injury, and over-strain or over-work, will not disqualify.)

(2) For the purpose of these regulations the following shall be the definitions of "Ringbone," "Sidebone," and "Curb":—

(*a*) Any exostosis on the antero or lateral aspect of the phalanges below the upper third of the *Os Suffraginis* shall constitute a Ringbone;

(*b*) Any ossification of the lateral cartilage shall constitute a Sidebone;

(*c*) Any circumscribed swelling on the posterior aspect of the hock in the median line and within the limits of the lower third of the hock and the head of the metatarsal bones shall constitute a Curb.

(3) The Certificate will also be refused in the case of animals considered by the Examining Officer to be below a reasonable standard for Government approval, as regards type, conformation, and breeding.

(4) Horses three or four years old, which are refused a Certificate as regards type, conformation, and breeding may be re-submitted annually until five years old, after which the refusal shall be subject to review under Part V. of these regulations only.

(5) In the case of horses that have been rejected for any reason whatsoever, a notification containing all particulars of identification shall be sent to all Chief Veterinary Officers of the other States of the Commonwealth as early as practicable after such examination has taken place.

III.—CERTIFICATES.

(1) Particulars concerning the identity of the horse—name, breeder, pedigree, age, prior ownership, &c.—must be furnished to the Examining Officer at the time of examination. If deemed necessary in any case the owner may be called upon to furnish a statutory declaration as to the correctness of such particulars.

(2) Certificates will be issued within seven days of the holding of the Parades, and will be forwarded to the owner direct. Secretaries of Societies under whose auspices the Parade is held will be notified which, if any, of the horses submitted for examination obtain their Certificates.

(3) The owners of horses for which a Certificate is refused will within seven days of such refusal be officially notified of the fact; the reason for such rejection will also be given.

(4) Until the issue of a Certificate, or until the publication of the official list of certificated stallions and mares, the result of the Veterinary examination will not be communicated to any person except as herein provided or under circumstances as follow:—The Examining Officer may, on request on proper occasion, communicate to the owner or his agent—duly authorized in writing to inquire—the result of the examination. In case of refusal of the Certificate the reasons for refusal will not under any circumstances, save in legal proceedings under the direction of the Court, be communicated to any person except the owner or his agent duly authorized in writing. Secretaries of Societies, persons in charge of the horse, grooms or relatives of the owner will not be considered authorized agents for that purpose unless

they deliver to the officer the owner's signed authority to receive the information.

(5) The Victorian Government Certificate of Soundness can only be issued in respect of horses three years old and over, that have been examined by a Victorian Government Veterinary Officer, or horses in respect of which any of the following certificates are produced:—

The Government Certificate of Soundness of any Australian State or New Zealand.

The Veterinary Certificate of the Royal Shire Horse Society (England).

The Veterinary Certificate of Royal Agricultural Society (England).

The Veterinary Certificate of Royal Dublin Society (Ireland).

The Veterinary Certificate of Highland and Agricultural Society (Scotland).

The Veterinary Certificate of Glasgow and West of Scotland Agricultural Society.

The Veterinary Certificate of the Board of Agriculture and Fisheries (England).

The Veterinary Certificate of the Board of Agriculture (Scotland).

Provided that such horses have been examined in accordance with these regulations.

Any horse which has been rejected by the Veterinary Examiners for any of the above certificates will not be eligible for examination for the Victorian Government Certificate of Soundness.

(6) The form of the Victorian Government Certificate of Soundness is as follows:—"G.R.—Department of Agriculture, Victoria, No. . Certificate of Soundness and Approval, issued for the season (*or issued for Life as the case may be*), given in respect of the (*breed*) stallion or mare (*name and description of stallion or mare*) submitted for Government inspection by the owner (*name of owner*) at (*place of examination*) such horse having been found suitable for stud service and free from hereditary unsoundness and defects of conformation predisposing thereto on examination by (*signature of Examining Officer*) Veterinary Officer on the day of 19 .

(Signature).

Chief Veterinary Officer.

Issued by direction of the Minister of Agriculture.

(Signature).

Director of Agriculture."

(7) Two-year-old colts may be submitted for examination and a temporary certificate will be issued in respect of such as pass the examination. Such temporary certificate must not be taken to imply suitability for stud service of approval as regards type, nor is the issue of it intended as an indication of the likelihood of a certificate being issued when submitted for examination at a more mature age.

(8) The season in respect of Government Certificates shall be considered as opening on 1st July. Horses passing the examination any

time during the three months previous to this date in New Zealand or Australia will be granted a Certificate for the season next following. In respect of horses examined in Great Britain examinations on or after 1st January will be considered as examinations for the following season.

(9) In the event of a Certificate issued to any owner being lost such owner may, on production of satisfactory evidence supported by statutory declaration, obtain the issue of a duplicate thereof on payment of a fee of £1 1s.

IV.—TENURE OF CERTIFICATE.

(1) Certificates issued during the season in respect of horses five years old and over are life certificates; those for three-year-olds and four-year-olds are season certificates only, and such horses must be submitted for re-examination at four and five years before a life certificate will be issued.

(2) The Season certificate issued in respect of any horse must be handed to the Examining Officer at the time of re-examination or forwarded to the Chief Veterinary Officer before a subsequent Season certificate or a Life certificate will be issued.

(3) The Minister retains the right to at any time have a certificated horse submitted for re-examination, and to withdraw the certificate, in the event of the animal being declared, to his satisfaction, unsound.

V.—BOARD OF APPEAL.

(1) Any owner of a stallion or mare who is dissatisfied with the refusal of a Government certificate in respect of his horse may appeal against the decision to the Minister at any time within *thirty* days of the examination, under the following conditions:—

- (*a*) That the appeal be in writing and be accompanied by the lodgment of £5, such amount to be forfeited in the event of the appeal *not* being upheld, unless the Board shall for good cause otherwise direct.
- (*b*) That the appeal be accompanied by an undertaking to pay any railway fares and hotel expenses incurred by the Board of Appeal in connexion with the settlement of the appeal.
- (*c*) That, in the event of refusal having been on the ground of unsoundness, the appeal be accompanied by a certificate from a registered Veterinary Surgeon setting out that the horse has been found by him on examination since the refusal appealed against to be free from all the unsoundnesses set out in Part II. of these regulations.
- (*d*) That, in the event of refusal having been on the ground of being below standard for Government approval, the appeal be accompanied by a certificate from the President and two members of the Committee of the Society under whose auspices the parade was held, setting out that in their opinion the horse is of fit and proper type, conformation, and breeding to be approved as a stud horse.

(2) On receipt of Notice of Appeal in proper form, and with the above conditions complied with, the Minister will appoint a Board of Appeal, which shall consist of:—

(*a*) In the case of appeals against refusal of certificate on the ground of unsoundness, the Chief Veterinary Officer and two practising Veterinary Surgeons.

(*b*) In the case of appeals against refusal of certificate as being below standard for Government approval, the Chief Veterinary Officer and two horsemen of repute and standing.

Such Board shall act and decide on the appeal, and its decision shall be final, and *not subject to review.*

(3) In the event of the appeal being allowed, refund shall be made of the deposit and any expenses paid by the appellant under Clause 1 (*b*). Further, the Board may recommend to the Minister the allowance of such of the expenses of the appellant in supporting his appeal as it may consider reasonable under the circumstances of the case, and the Minister may, in his discretion, confirm the recommendation in whole or in part, whereupon allowance shall be made to the appellant accordingly.

(4) No horse in respect of which a Government certificate is refused will be allowed to be re-submitted for examination except in the case of an appeal or in such case as when a three or four years old horse has been refused on account of type as herein provided for. In the event of any rejected horse being re-submitted for examination under another name or under such circumstances as in the opinion of the Minister are calculated to mislead the Examining Officer into the belief that the horse has not previously been examined, the owner of such rejected horse, if proved to the satisfaction of the Minister that he is responsible for such re-submission, shall be debarred from submitting any horse for examination for such period as the Minister shall determine.

(5) In these regulations the words "stallion" or "horse" shall, unless the context clearly indicates to the contrary, be taken to mean either stallion or mare or animal of either sex, provided that in respect of mares only those which are registered in a recognised Stud Book for Draught Horses shall be examined.

NOTICE TO SECRETARIES OF AGRICULTURAL SOCIETIES.

* Section "A" of the conditions to be complied with by Agricultural Societies before being eligible for participation in the annual Government grant is as follows:—

"*A.—That the awards of prizes in all classes for stallions, three years old and over, at the Society's Show must be subject to the possession by the exhibit of a Government certificate of soundness.*"

In order to comply with the above, the special attention of show secretaries is invited to the receiving of entries in stallion classes. No

* Whilst no grant is to be made during the coming year this notice is reproduced as a guide to Secretaries of those Societies who intend to carry out the Regulations.

entry should be received unless at the time of entry the Government certificate is produced, or unless satisfactory evidence is given that a Government certificate is held by the owner in respect of the exhibit. The awarding of a prize card and the withholding of prize money in respect of any exhibit shall not be deemed as compliance with the condition. Care should be taken also to see that the certificate is not out of date, that is to say:—

For three-year-olds, a 1917 three-year-old certificate must be held.

For four-year-olds, a 1917 four-year-old certificate must be held (the 1916 certificates are out of date).

For horses five years old and over, a life certificate must be held.

Horses holding Government certificates issued by any other State are not eligible to compete at shows unless such certificate is endorsed by the Victorian Department, "Recognised for Victorian Shows."

Particular attention is directed to the method now in vogue of classifying certificated stallions. The list is now divided into horses carrying a life certificate and those which are terminable, and supplementary lists will be issued annually which should be added to those listed in Bulletins No. 30, No. 17, No. 24, and Nos. 30 and 33 (New Series).

Secretaries are strongly urged to become familiar with the regulations, particularly Regulation IV., which deals with the tenure of certificates.

Secretaries are required to *forward immediately after the show* a return (forms for which will be sent to each society) giving required particulars concerning 1st, 2nd, and 3rd prize winners as under:—

RETURN to be forwarded to the Chief Veterinary Officer concerning Stallions (three years old and over) awarded Prizes at the .... Agricultural Society's Show held ....

Name of Stallion.	Certificate Number.	Name of Class and Section (not Number).	Prize Awarded. 1st.	2nd.	3rd.	Owner's Name.	Owner's Address.

(Signed) ....

Secretary .... Agricultural Society

Date ....

STALLION PARADES.

TIME TABLE, 1917.

(Subject to alteration on short notice.)

District and Date	Place.	Time.	Officer Arrives.	Officer Departs.
SPECIALS.				
Every Saturday :— June 23 to Dec. 22 ..	Agricultural Offices	10 a.m. to 12 noon		
July 23 to July 25 ..	Royal Show Grounds			
MALLEE No. 1.				
Tuesday, July 3 ..	Mildura ..	2 p.m. ..	7 a.m. ..	6 p.m.
Wednesday, July 4 ..	Ouyen ..	2 p.m. ..	9.45 p.m. (3rd)	9.45 p.m.
Thursday, July 5 ..	Sea Lake ..	3 p.m. ..	Driving ..	8.30 a.m. (6th)
Friday, July 6 ..	Wycheproof	11.50 a.m.	11.50 a.m. ..	12.40 p.m.
WIMMERA No. 1.				
Monday, July 9 ..	Ararat ..	2 p.m. ..	1.27 p.m. ..	11.53 p.m.
Tuesday, July 10 ..	Goroke ..	3.30 p.m...	2 p.m. ..	6 p.m.
Wednesday, July 11 } Thursday, July 12 }	Horsham ..	10 a.m. ..	12.20 p.m. (10th)	4.40 p.m. (12th)
Friday, July 13 ..	Stawell ..	12 noon ..	7.46 p.m. (12th)	2.40 p.m.
WESTERN No. 1.				
Tuesday, July 31 ..	Coleraine ..	11 a.m. ..	7.35 p.m. (30th)	Driving
Tuesday, July 31 ..	Casterton ..	3 p.m. ..	Driving ..	8.30 a.m. (1st)
Wednesday, August 1	Hamilton ..	3 p.m. ..	12 noon ..	6.45 a.m. (2nd)
Thursday, August 2 ..	Warrnambool	12 noon ..	10.27 a.m. ..	3.15 p.m.
Friday, August 3 ..	Camperdown	10 a.m. ..	5.10 p.m. (2nd) ..	Driving
Friday, August 3 ..	Colac ..	2 p.m. ..	Driving ..	3.35 p.m.
WIMMERA No. 2.				
Tuesday, August 7 ..	Rainbow ..	3 p.m. ..	1.55 p.m. ..	8.10 p.m.
Wednesday, August 8	Minyip ..	3.30 p.m...	Driving	6.22 p.m.
Thursday, August 9 ..	Hopetoun ..	9 a.m. ..	10.40 p.m. (8th)	10.50 a.m.
Thursday, August 9 ..	Warracknabeal	3 p.m. ..	1.35 p.m. ..	10.30 a.m. (10th)
Friday, August 10 ..	Murtoa ..	2 p.m. ..	12.30 p.m. ..	5.50 p.m.
WESTERN No. 2.				
Thursday, August 9 ..	Geelong ..	3 p.m. ..	12.50 p.m. ..	6 p.m.

STALLION PARADES, TIME TABLE—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Departs.
WIMMERA No. 3.				
Tuesday, August 14 ..	Kaniva ..	2 p.m. ..	2.28 a.m. ..	12.42 a.m. (15th)
Wednesday, August 15	Nhill ..	2 p.m. ..	1.24 a.m. ..	8.47 a.m. (16th)
Thursday, August 16	Dimboola ..	2 p.m. ..	10.19 a.m. ..	11 a.m. (17th)
Friday, August 17 ..	Jeparit ..	2 p.m. ..	12.23 p.m. ..	9.53 p.m.
MALLEE No. 2 AND CENTRAL No. 1.				
Tuesday, August 21 ..	Birchip ..	10 a.m. ..	8.20 p.m. (20th)	Driving
Tuesday, August 21 ..	Donald ..	3 p.m. ..	Driving ..	5.50 a.m. (22nd)
Wednesday, August 22	St. Arnaud ..	10 a.m. ..	7.11 a.m. ..	2.10 p.m.
Wednesday, August 22	Maryborough	5 p.m. ..	5 p.m. ..	6.30 p.m.
Thursday, August 23	Smeaton ..	10 a.m. ..	Driving ..	Driving
Thursday, August 23	Daylesford ..	2 p.m. ..	Driving ..	3.15 p.m.
Friday, August 24 ..	Rochester ..	9 a.m. ..	9.49 p.m. (23rd)	Driving
Friday, August 24 ..	Elmore ..	11 a.m. ..	Driving ..	1.11 p.m.
Friday, August 24 ..	Echuca ..	2.15 p.m.	2.15 p.m. ..	3.45 p.m.
MALLEE No. 3.				
Monday, August 27 ..	Pyramid ..	3 p.m. ..	2.17 p.m. ..	9.4 p.m.
Tuesday, August 28 ..	Kerang ..	12 noon ..	10.16 p.m. (27th)	4.13 p.m
Wednesday, August 29	Swan Hill ..	9 a.m. ..	6.25 p.m. (28th)	10.50 a.m.
Wednesday, August 29	Quambatook	3 p.m. ..	Driving ..	Driving
Thursday, August 30	Bendigo ..	11 a.m. ..	10.45 a.m. ..	12.15 p.m.
Friday, August 31 ..	Charlton ..	11 a.m. ..	4.7 p.m. (30th) ..	1.45 p.m.
NORTH-EASTERN No. 1.				
Monday, Sept. 3 ..	Rutherglen	2 p.m. ..	1.53 p.m. ..	3.22 p.m.
Tuesday, Sept. 4 ..	Yarrawonga	10 a.m. ..	10.5 p.m. (3rd)	Driving
Tuesday, Sept. 4 ..	Tungamah	3.30 p.m.	Driving ..	8.6 a.m. (5th)
Wednesday, Sept. 5 ..	Benalla ..	10 a.m. ..	10 a.m. ..	11.25 a.m.
Wednesday, Sept. 5 ..	Wangaratta	2 p.m. ..	12.7 p.m. ..	4.37 p.m.
Thursday, Sept. 6 ..	Euroa ..	10 a.m. ..	6.33 p.m. (5th)	11.12 a.m.
Thursday, Sept. 6 ..	Seymour ..	2 p.m. ..	12.11 p.m. ..	6.15 p.m.
Friday, Sept. 7 ..	Murchison ..	9.30 a.m.	7.32 p.m. (6th)	10.58 a.m.
Friday, Sept. 7 ..	Rushworth	2 p.m. ..	11.48 a.m. ..	5.20 p.m.

STALLION PARADES, TIME TABLE—*continued.*

District and Date.	Place.	Time.	Officer Arrives.	Officer Departs
GOULBURN VALLEY No. 1.				
Monday, Sept. 10 ..	Numurkah ..	1 p.m. ..	12.18 p.m. ..	Driving
Monday, Sept. 10 ..	Cobram ..	2.30 p.m.	Driving ..	Driving
Monday, Sept. 10 ..	Nathalia ..	4.30 p.m.	Driving ..	Driving
Tuesday, Sept. 11 ..	Dookie ..	10 a.m. ..	Driving ..	Driving
Tuesday, Sept. 11 ..	Shepparton..	1 p.m. ..	Driving ..	Driving
Tuesday, Sept. 11 ..	Kyabram ..	3 p.m. ..	Driving ..	Driving
Wednesday, Sept. 12..	Mansfield ..	2 p.m. ..	1.50 p.m. ..	3.30 p.m.
Thursday, Sept. 13 ..	Alexandra ..	2 p.m. ..	12.25 p.m. ..	4.40 p.m.
Friday, Sept. 14 ..	Kilmore ..	9.30 a.m ..	9.30 p.m. (13th)	10 a.m.
Saturday, Sept. 15 ..	Werribee ..	12 noon ..	11.47 a.m. ..	1.36 p.m.
CENTRAL No. 2.				
Monday, Sept. 17 ..	Mernda ..	2 p.m. ..	12.:9 p.m. ..	8.23 p.m.
Tuesday, Sept. 18 ..	Kyneton ..	3.30 p.m...	2.55 p.m. ..	5.25 p.m.
Wednesday, Sept. 19	Romsey ..	2 p.m. ..	10.41 a.m. ..	5.25 p.m.
Friday, Sept. 21 ..	Ballan ..	9 a.m. ..	6.33 p.m. (20th)	10.5 a.m.
Friday, Sept. 21 ..	Ballarat ..	12 noon ..	11.8 a.m. ..	3.5 p.m.
SPECIAL.				
Monday, Sept. 24 ..	Royal Show	9 a.m.		
GIPPSLAND No. 1.				
Monday, October 1 ..	Warragul ..	2 p.m. ..	10.30 a.m. ..	7.36 p.m.
Tuesday, October 2 ..	Trafalgar ..	10 a.m. ..	8.8 p.m. (1st) .	11.16 a.m.
Tuesday, October 2 ..	Bairnsdale ..	3.30 p.m.	3.25 p.m. ..	5.40 a.m. (3rd)
Wednesday, October 3	Maffra ..	10 a.m. ..	7.14 a.m. ..	12.53 p.m.
Wednesday, October 3	Traralgon ..	3.45 p.m...	3.40 p.m. ..	5.57 p.m.
Thursday, October 4	Dandenong	3 p.m. ..	9.32 p.m. (3rd)..	6 p.m.
Friday, October 5 ..	Korumburra	3 p.m. ..	8.24 p.m. (4th)..	5.5 p.m.
GIPPSLAND No. 2.				
Monday, October 8 ..	Lilydale ..	3 p.m. ..	1.45 p.m. ..	5.35 p.m.
Tuesday, October 9 ..	Dalyston ..	2 p.m. ..	10.51 a.m. ..	3.57 p.m.
Wednesday, Oct. 10 ..	Leongatha ..	10 a.m. ..	9.7 p.m. (9th) ..	11.4 a.m.
Wednesday, Oct. 10 ..	Foster ..	2 p.m. ..	12.30 p.m. ..	9.1 p.m.
Thursday, October 11	Yarram ..	10 a.m. ..	10.30 p.m. (10th)	11 a.m.
NORTH-EASTERN No. 2.				
Tuesday, October 16..	Tallangatta	4.35 p.m.	4.35 p.m. ..	5 a.m. (17th)
Wednesday, Oct. 17..	Corryong ..	3.30 p.m.	3.30 p.m. ..	7 a.m. (18th)
GIPPSLAND No. 3.				
Wednesday, Oct. 17 ..	Orbost ..	3 p.m. ..	8.50 p.m. (16th)	6.40 a.m. (18th)
Wednesday, Oct. 24 ..	Omeo ..	3 p.m. ..	6.30 p.m. (23rd)	6.30 a.m. (25th)

SUPPLEMENTARY LIST OF LIFE CERTIFICATED STALLIONS.

Cert. No.	Name of Horse.	Age.	Owner.	Parade.	Date of Examination.	Officer.
			DRAUGHTS.			
2910	Arawa	5 years	Executors of the late J. R. Mackenzie	Glenroy Spec.	11.7.16	W.M.L.
2956	Baron Abbot	5 years	McNamara and McDougall	Yarrawonga	5.9.16	R.G.
2930	Baron Milford	5 years	A. C. Petrass	Minyip	9.8.16	W.M.L.
2919	Baron Samson	5 years	Geo. Stokes	Newmarket	25.7.16	R.G.
2916	Barons Fashion	5 years	Geo. Stokes	City Horse Bazaar	17.7.16	W.M.L.
2980	Bonnie Lad	6 years	N. W. McInnes	Traralgon	4.10.16	W.M.L.
2907	Border King	6 years	Geo. Stokes	Agricultural Offices	24.6.16	R.G.
5849*	Clandale	Aged	New South Wales Government	New South Wales Exam.	5.7.16	..
2937	Clermont	5 years	G. C. Dufty	Jeparit	18.8.16	R.G.
2981	Cock Robin	6 years	P. H. Beaton	Traralgon	4.10.16	W.M.L.
2927	Colonel Garfield	5 years	Colyer Brothers	Colac	4.8.16	R.G.
2939	Colonel Young	5 years	H. W. Oberin	Elmore	25.8.16	W.M.L.
2949	Craigmore	6 years	W. R. Smith	Swan Hill	30.8.16	W.M.L.
2989	Dalmore	Aged	Mitchell and O'Brien	New Zealand	5.2.17	..
2931	Eastern Star	5 years	D. and G. McDonald	Minyip	9.8.16	W.M.L.
2917	Hampton Style	5 years	R. A. Staughton	Newmarket Spec.	24.7.16	R.G.
2932	Herdsman	5 years	H. Daniels	Warracknabeal	10.8.16	W.M.L.
2913	Invermay	5 years	A. Colvin	City Horse Bazaar	17.7.16	R.G.
2966	King Albert	5 years	T. McKay	Kyneton	19.9.16	R.G.
2969	King's Adventure	..	Dean Brothers	Sydney Show	16.4.16	..
2923	Lee Creek Bonns	5 years	W. T. Harris	New Zealand Exam.	13.6.16	..
2971	Locksley	6 years	O. Noske	Ararat	21.9.16	W.M.L.
2954	Lyndale	5 years	A. McKinnon	Charlton	1.9.16	W.M.L.
2940	Model King	5 years	H. Boyd	Elmore	25.8.16	W.M.L.
2915	Montrave	6 years	J. and G. Badman	New Zealand Exam.	15.6.16	.
2947	Newton Prince	5 years	H. C. Younger	Wangaratta	30.8.16	R.G.
2934	Orbost Again	5 years	P. A. Deckert	Nhill	16.8.16	R.G.
2988	Plunket's Pride	5 years	T. Crouch, senior	Welshpool Special	13.2.17	W.M.L.
2950	Premier Thomas	5 years	W. MacKnight	Swan Hill	30.8.16	W.M.L.
2944	Royal Garvin	6 years	G. W. White	Agricultural Offices	13.5.16	R.G.
2951	Royal Ribbon	5 years	G. Pearse	Swan Hill	30.8.16	W.M.L.
2908	Scottie	5 years	Mitchell and O'Brien	Horsham	5.7.16	R.G.
2943	Shepherd King	5 years	J. Erwin, senior	Pyramid	28.8.16	W.M.L.
2912	Shepherd Mac	7 years	J. Stokes	City Horse Bazaar	17.7.16	W.M.L.
2922	Sir Hallam	6 years	E. Lloyd Jones	New Zealand Exam.	13.6.16	..
2921	Squire Athol	6 years	Geo. Stokes	New Zealand Exam.	26.6.16	..
2935	Starlight	5 years	H. C. M. Pilgrim	Nhill	16.8.16	R.G.
2918	Thorn Blend	5 years	Geo. Stokes	Newmarket Special	24.7.16	W.M.L.
2920	Thorndale Hero	6 years	Mitchell and O'Brien	New Zealand Exam.	26.6.16	..
2983	Young Champion II.	Aged	A. McDonald	Agricultural Offices	14.10.16	R.G.
2953	Young Clydeside	5 years	H. Steen	Bendigo	31.8.16	W.M.L.
2952	Young Hero	6 years	A. Ward	Swan Hill	30.8.16	W.M.L.

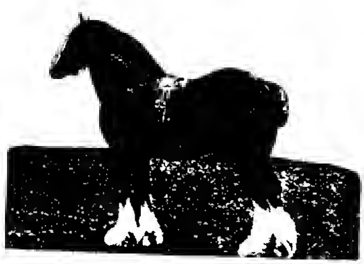
* N.S.W.

			THOROUGHBREDS.			
2987	Bengore	5 years	J. Blair	Caulfield Special	18.12.16	R.G.
2925	Capshot	Aged	T. Jones	Casterton	1.8.16	R.G.
2970	Carman	Aged	Thirkell Brothers	Tasmanian Exam.	14.7.15	
2962	Fifeness	Aged	C. McLean	Mansfield	13.9.16	W.M.L.
2933	Kingling	Aged	Geo. Devereaux	Warracknabeal	10.8.16	W.M.L.
2963	Lithgow	Aged	W. Maloney	Shepparton	12.9.16	W.M.L.

			LIGHT HORSES.			
2945	Belmont Chimes	5 years	P. H. Busst	Kerang	29.8.16	W.M.L.
2977	Blackboy	5 years	J. Killeen	Sale	3.10.16	W.M.L.
2936	Bonnie Palm	5 years	W. A. Pollock	Jeparit	18.8.16	R.G.
2957	Corva	5 years	A. G. Hunter	Seymour	7.9.16	R.G.

Supplementary List of Life Certificated Stallions—*continued.*

Cert. No.	Name of Horse.	Age.	Owner.	Parade.	Date of Examination.	Officer.
	Light Horses—*continued.*					
	Derby Chimes	..	H. Saunders	New South Wales Exam.	..	..
2976	Don Marvin	Aged	L. Taylor	Agricultural Offices	4.10.16	R.G.
2938	Ecstasy	5 years	V. Hardy	Agricultural Offices	26.8.16	W.M.L.
2929	Federal Chimes	5 years	D. Rowe	Camperdown	4.8.16	R.G.
2982	Glynne	Aged	G. Collis	Yarram	12.10.16	R.G.
2972	Happy Voyage	5 years	G. M. Gilbert	Ballarat	22.9.16	W.M.L.
2975	Jack McKinney	5 years	D. Moriarty	Agricultural Offices	3.10.16	R.G.
2964	Marcus	5 years	N. Jones	Agricultural Offices	15.9.16	W.M.L.
2960	Merry Peals	Aged	D. McLeod	Kyabram	12.9.16	W.M.L.
2928	Orewar	Aged	T. J. Pratt	Colac	4.8.16	R.G.
2967	Preston Junior	Aged	McLure Brothers	Kyneton	19.9.16	R.G.
2941	Retso	5 years	F. J. Wallis	Elmore	25.8.16	W.M.L.
2946	Silver King	6 years	W. Harris	Kerang	29.8.16	W.M.L.
2942	Springwood	..	G. J. Jagg	South Australian Exam.	4.9.16	..
2958	Wee Wood	6 years	R. M. Wilson	Yarrawonga	5.9.16	R.G.
	PONIES.					
2914	Arabian	5 years	D. Fuller	Ouyen	12.7.16	R.G.
2973	Fimbric True Blue	6 years	G. L. Wilson	Royal Show Grounds	25.9.16	W.M.L.
2978	Cyndette	Aged	H. A. Gooch	Sale	3.10.16	W.M.L.
2961	Dandy Lad	Aged	A. C. Head	Mansfield	13.9.16	W.M.L.
2959	Don Olive	Aged	F. A. Cheesley	Rutherglen	4.9.16	R.G.
2984	Future	Aged	McMillan Brothers	Caldermeade	18.10.16	Appeal Board
2911	Gay Gordon	5 years	Will Black	Glenroy Special	11.7.16	W.M.L.
2926	Harry Lauder	5 years	L. H. Fraser	Hamilton	2.8.16	R.G.
2955	Ken Stewart	5 years	F. Hooper	Dookie	12.9.16	W.M.L.
2974	Lou's Gift	Aged	A. Bloxham	Royal Show	25.9.16	W.M.L.
2979	Little Tich	Aged	L. M. Roberts	Sale	3.10.16	W.M.L.
2985	Prince Taff	Aged	T. Folliott Sandford	Royal Show	26.9.16	Appeal Board
2968	Romance	5 years	Ingram Brothers	Romsey	20.9.16	R.G.
2918	Sandy	Aged	C. Lennon	Wangaratta	30.8.16	R.G.
2946	Silver King	6 years	W. Harris	Kerang	29.8.16	W.M.L.
2965	Steadaway	5 years	H. Sawers	Alexandra	14.9.16	W.M.L.
2966	Stylish Lad	6 years	E. J. Watson	Agricultural Offices	15.4.16	R.G.
2996	Wee Jock	5 years	J. Whitten	Agricultural Offices	8.10.16	W.M.L.
2901	Woodland's Dandy	5 years	A. Cameron	Horsham	5.7.16	R.G.



LIST OF TERMINABLE CERTIFICATED STALLIONS.

(Four-year-old Certificates expiring 30th June, 1917.)

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
	DRAUGHTS.				
1117/4	Abbot's Best	J. Egan	Mansfield	13.9.16	W.M.L.
1135/4	Abbotsford Champion	C. Elphick	Foster	11.10.16	R.G.
1087/4	Abbotsford Signet	M. Hearne	Royal Show Grounds	24.7.16	R.G.
1094/4	Abbotsford Splendour	J. Tallent	New Zealand Exam.	29.5.16	..
1075/4	Baron Abbot	P. McDonald	City Horse Bazaar	17.7.16	W.M.L.
1134/4	Baron Alexander	R. N. Scott	Korumburra	6.10.16	R.G.
1074/4	Baron Albert	P. McDonald	City Horse Bazaar	17.7.16	W.M.L.
1089/4	Baron Alvie	A. Collis	New Zealand Exam.	26.6.16	..
1129/4	Baron Carlyle	A. Gillies	Royal Show	25.9.16	W.M.L.
1078/4	Baron Erskine	W. French and Sons	City Horse Bazaar	17.7.16	R.G.
1109/4	Baron's Reserve	R. Bushby	Jeparit	18.8.16	R.G.
1124/4	Belmont's Champion	Turner Brothers	Mernda	18.9.16	R.G.
1095/4	Bold Marquis	E. Wright and Son	New Zealand Exam.	29.5.16	..
1084/4	Chatham Lad	E. E. Jenkins	New Zealand Exam.	15.6.16	
1107/4	Chief Fashion	Donovan Brothers	New Zealand Exam.	1.7.16	
1113/4	Colonel Dale	T. F. Major	Kerang	29.8.16	W.M.L.
1032/4	Dick Hamilton	R. Broooks	Ouyen	12.7.16	R.G.
1088/4	Dunsmore Minstrel	R. Tucker	Horsham	5.7.16	R.G.
1101/4	Forrester	C. Lusfell	Newmarket	8.8.16	W.M.L.
1035/4	General Joffre	C. P. House	New Zealand Exam.	29.5.16	..
1096/4	General Kitchener	W. Reid	New Zealand Exam.	29.5.16	..
1120/4	Glencoe	L. McLeod	Shepparton	12.8.16	W.M.L.
1076/4	Herod Again	S. Stephen	City Horse Bazaar	17.7.16	W.M.L.
1099/4	Lee Creek Squire	W. Underwood	Colac	4.8.16	R.G.
1112/4	Lord Melbourne	J. Douglas	Maryborough	23.8.16	W.M.L.
1097/4	Lord Valcourt	J. H. Roulston	Coleraine	1.8.16	R.G.
1132/4	Marmion	Geo. Murdie	Warragul	2.10.16	W.M.L.
1104/4	Moira Lyon	J. C. Tipper	Murtoa	11.8.16	W.M.L.
1030/4	Mosgiel King	O. E. Bodey	New Zealand Exam.	10.6.16	
1100/4	On It Fashion	J. E. Robertson	Colac	4.8.16	R.G.
1123/4	Onward Brae	Hugh Gilmore	Alexandra	14.9.16	W.M.L.
1121/4	Onward's Star	Wm. Powles	Shepparton	12.9.16	W.M.L.
1079/4	Premier King	Mitchell and O'Brien	City Horse Bazaar	17.7.16	R.G.
1115/4	Pride of the North	D. Blair	Charlton	1.8.16	W.M.L.
1133/4	Prince Alexander	J. B. Talbot	Sale	5.10.16	W.M.L.
1122/4	Prince Onward	Jas. Alexander	Shepparton	12.9.16	W.M.L.
1108/4	Queen's First	Paul Müller	Dimboola	17.8.16	R.G.
1092/4	Rab the Ranter	E. Roberts	New Zealnd Exam.	21.6.16	
1039/4	Repetition	A. Stanley	Horsham	5.7.16	R.G.
1125/4	Royal Belmont	Turner Brothers	Mernda	18.9.16	R.G.
1103/4	Royal Colours	A. D. Hiscock	Warracknabeal	10.8.16	W.M.L.
1080/4	Royal Fyvie	Mitchell and O'Brien	City Horse Bazaar	17.7.16	R.G.
1077/4	Royal Laddie	Mitchell and O'Brien	City Horse Bazaar	17.7.16	W.M.L.
1091/4	Sir William	W. McLellan	New Zealand Exam.	13.6.16	..
1093/4	Stirling Hero	A. Blair	New Zealand Exam.	10.6.16	
1118/4	Sulbourn's Model	A. C. Head	Mansfield	13.9.16	W.M.L.
1036/4	The Reformed Fashion	J. Burns	Newmarket	24.7.16	W.M.L.
1038/4	The Saxon	Mitchell and O'Brien	City Horse Bazaar Special	26.7.16	R.G.
1073/4	Winter's Pride	Mitchell and O'Brien	City Horse Bazaar	17.7.16	W.M.L.
	LIGHT HORSES.				
1031/4	Al Borak	T. McCarthy	Mildura	11.7.16	R.G.
1114/4	Bay Voyage	A. Truscott	Bendigo	31.8.16	W.M.L.
1127/4	Black Huon	T. Hynes	Ballarat	22.9.16	W.M.L.
1119/4	Bob Ash	Thos. Moore	Shepparton	12.9.16	W.M.L.
1137/4	Dixie Boodle	C. Zimmer	Agricultural Offices	28.10.16	W.M.L.
1111/4	Direct Lulu	R. London	Maryborough	23.8.16	W.M.L.
1136/4	First Aid	Geo. Collis	Yarram	12.10.16	R.G.
1130/4	Georgie B.	A. E. Batson	Royal Show	25.9.16	W.M.L.
1072/4	Gratton Again	W. J. Parish	Horsham	5.7.16	R.G.
1033/4	Lahore	Jessa Singh	Sea Lake	13.7.16	R.G.
1116/4	Madras	J. Beattie	Dookie	12.9.16	W.M.L.
1131/4	Oscar Asche	E. Partridge	Royal Show	25.9.16	W.M.L.
1105/4	Shandon Bells	H. C. H. Hately	Murtoa	11.8.16	W.M.L.
1070/4	Sir Iver	Mrs. R. Dorl	Horsham	5.7.16	R.G.
1071/4	The Butler	H. Pearson	Horsham	5.7.16	R.G.
1128/4	Young Robin	E. Heath	Ballarat	22.9.16	W.M.L.

LIST OF TERMINABLE CERTIFICATED STALLIONS—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
	PONIES.				
1098/4	Berkeley's Swell	D. J. Reen	Hamilton	2.8.16	R.G.
1102/4	Dandy's Double	C. O'Donnell	Warracknabeal	10.8.16	W.M.L.
1106/4	Railway II.	W. Peacock	Agricultural Offices	12.8.16	W.M.L.
1126/4	Viscount	P. Quirk	Romsey	20.9.16	R.G.
	(Three-year-old Certificates expiring 30th June, 1917.)				
	DRAUGHTS.				
1691/3	Abbot's Pride	N. E. Dahlenberg	Nhill	16.8.16	R.G.
1647/3	Adjutant	Mitchell and O'Brien	City Horse Bazaar	17.7.16	W.M.L.
1652/3	Baron Asquith	J. H. Meyer	City Horse Bazaar	17.7.16	W.M.L.
1711/3	Baron Bolobek	O. Syme	Royal Show	25.9.16	R.G.
1715/3	Baron Fenwick	S. J. Lynn	Orbost	17.10.16	R.G.
1673/3	Baron Noble	J. Stokes	New Zealand Exam.	26.6.16	..
1698/3	Baron's Royal Chief	T. E. Parry	St. Arnaud	23.8.16	W.M.L.
1708/3	Baron Stanley	W. M. Rowan	Kyneton	19.9.16	R.G.
1668/3	Baron Townsend	J. Stokes	New Zealand Exam.	26.6.16	..
1682/3	Bloomsbury	J. McLean and Sons	New Zealand Exam.	25.6.16	..
1654/3	Bold Gordon	H. Rockcliffe	City Horse Bazaar	17.7.16	W.M.L.
1670/3	Bold MacGregor	T. Cantwell	New Zealand Exam.	13.6.16	..
1672/3	Bold Newton	J. R. Mitchell	New Zealand Exam.	13.6.16	..
1675/3	Bold Patron	C. T. Henderson	New Zealand Exam.	13.6.16	..
1613/3	Bold Sovereign	W. H. Allan	New Zealand Exam.	13.6.16	..
1655/3	Briton's Hero	Geo. Burrows	City Horse Bazaar	17.7.16	R.G.
1666/3	Castle Douglas	Mitchell and O'Brien	City Horse Bazaar	17.7.16	R.G.
1674/3	Claymore	Mitchell and O'Brien	Agricultural Offices	5.8.16	W.M.L.
1616/3	Commander	T. Caldwell	City Horse Bazaar	17.7.16	W.M.L.
1649/3	Coupar Grange	Mitchell and O'Brien	City Horse Bazaar	17.7.16	W.M.L.
1650/3	Director	C. H. Fehltmann	City Horse Bazaar	17.7.16	W.M.L.
1661/3	Dunsmore Ranger	W. T. Boley	Horsham	5.7.16	R.G.
1645/3	Drumflower's Pride	J. and G. Badman	City Horse Bazaar	17.7.16	W.M.L.
1684/3	Earl of Ury Park	J. Hehling	New Zealand Exam.	10.6.16	..
1658/3	Enterprise	W. French and Son	Horsham	5.7.16	R.G.
1644/3	Favourite's Best	J. and G. Badman	City Horse Bazaar	17.7.16	W.M.L.
1701/3	Flashlight	Thos. Lees	Rochester	25.8.16	W.M.L.
1680/3	General Birdwood	C. Thompson	New Zealand Exam.	29.5.16	..
1662/3	General Haig	Mitchell and O'Brien	City Horse Bazaar	17.7.16	R.G.
1659/3	Gisborne	W. E. Millstead	Horsham	5.7.16	R.G
1697/3	Glen Talbot	J. and G. Badman	New Zealand Exam.	15.6.16	..
1648/3	High Time	Mitchell and O'Brien	City Horse Bazaar	17.7.16	W.M.L.
664/3	Hillend Knight	W. M. Black	City Horse Bazaar	17.7.16	R.G.
608/3	King Cellus	H. P. Linke	Horsham	5.7.16	R.G.
657/3	King of Ury Park	W. Hicks	New Zealand Exam.	10.6.16	..
692/3	Larnda	J. Bunge	Warracknabeal	10.8.16	W.M.L.
677/3	Lee Creek Advance	Thompson Brothers	New Zealand Exam.	13.6.16	..
663/3	Lee Creek Favourite	Ewart Brothers	New Zealand Exam.	13.6.16	..
681/3	Lord Douglas	M. T. Padbury	New Zealand Exam.	25.6.16	..
690/3	Lord Salisbury	R. McKenzie	Warracknabeal	10.8.16	W.M.L.
642/3	Maghlan	W. J. Williams	Agricultural Offices	24.6.16	R.G.
683/3	Major Dale	F. J. Edwards	Charlton	1.8.16	W.M.L.
655/3	Noble Knight	Mitchell and O'Brien	Horsham	5.7.16	R.G.
693/3	Northern Chief	H. E. Huf	Rainbow	8.8.16	W.M.L.]
655/3	Ochtertyre Ronald	Mitchell and O'Brien	City Horse Bazaar	17.7.16	R.G.
657/3	Ochtertyre Prince	Mitchell and O'Brien	City Horse Bazaar	17.7.16	R.G.
651/3	Pride of Inverness	W. C. Brabender	St. Arnaud	23.8.16	W.M.L.
663/3	Pride of Ury Park	R. A. Smales	New Zealand Exam.	10.6.16	..
643/3	Prince Coupar	J. Archibald	City Horse Bazaar	17.7.16	W.M.L.
685/3	Prince of Ury Park	C. H. Probert	New Zealand Exam.	10.6.16	..
718/3	Ronald	Mitchell and O'Brien	Royal Show	25.9.16	W.M.L.
691/3	Royal Charm	F. W. Sallman	Nhill	16.8.16	R.G.
686/3	Royal Douglas	T. Thornton	New Zealand Exam.	25.6.16	..
697/3	Royal Harp	Kelm Brothers	Jeparit	18.8.16	R.G.
671/3	Royal Milton	W. Long	New Zealand Exam.	29.5.16	..
695/3	Royal Willie	F. W. Sallman	Nhill	16/8/16	R.G.
578/3	St. Mark	F. W. Marshman	New Zealand Exam.	13.6.16	..
707/3	Standard Bearer	W. J. Thornton	Numurkah	11.9.16	W.M.L.
653/3	The Monk	J. D. Ormond	City Horse Bazaar	17.7.16	W.M.L.
658/3	The Standard	G. W. Pickford	Horsham	5.7.16	R.G.
679/3	Waterside Bold	H. Chaston	New Zealand Exam.	13.6.16	..
680/3	Willie Ronald	J. Grey	New Zealand Exam.	26.6.16	..
688/3	Winsome's Pride	B. Scanlon	New Zealand Exam.	29.5.16	..
696/3	Young Nailstone	Schroeder Brothers	Nhill	16.8.16	R.G.

List of Terminable Certificated Stallions—*continued.*

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
	LIGHT HORSES.				
1704/3	Ben Marcelene ..	A. F. Cox ..	Agricultural Offices ..	2.9.16	W.M.L.
1710/3	Colmar Chimes ..	Cochrane and Sons ..	Ballarat	22.9.16	W.M.L.
1702/3	Epicure	Dr. Henderson ..	Wangaratta	30.8.16	R.G.
1714/3	Marmaduke	H. Thompson ..	Royal Show ..	29.9.16	R.G.
1709/3	Second Voyage ..	F. J. Boddy ..	Kyneton	19.9.16	R.G.
	PONIES.				
1706/3	Crown Prince.. ..	J. A. Lane ..	Mansfield	13.9.16	W.M.L.
1712/3	Hermes of Shetland Heights	Mrs. J. Maclellan ..	Royal Show	25.9.16	W.M.L.
1705/3	Revenue	Walker Brothers ..	Euroa	7.9.16	R.G.
1703/3	Young Balaween ..	T. Morley	St Arnaud	23.8.16	W.M.L.

(Two-year-old Certificates expiring 30th June, 1917.)

Cert. No.	Name of Horse.	Owner.	Parade.	Date of Examination.	Officer.
	DRAUGHTS.				
252/2	Cowden's Favourite ..	Mitchell and O'Brien	New South Wales Exam.	14.4.16	..
251/2	Cowden's Renown ..	Mitchell and O'Brien	New South Wales Exam.	14.4.16	..
250/2	Cranbourne	Mitchell and O'Brien	New South Wales Exam.	14.4.16	..
249/2	Fortune	W. F. Boley ..	Horsham	5.7.16	R.G.
5848/2 N.S.W.	Glenalmond ..	Gillies and Walter ..	New South Wales Exam.	14.4.16	..
253/2	Shepherd Boy ..	A. H. Taylor ..	Birchip	22.8.16	W.M.L.
	LIGHT HORSES.				
254/2	Royal Guinea.. ..	J. Pretty	Warragul	2.10.16	W.M.L.

APPLE CULTURE IN VICTORIA.

By J. Farrell, Orchard Supervisor.

(Continued from page 157.)

SUMMER PRUNING.

There are three prime factors which govern the practice of Summer pruning. The first is the "early," complete or partial suppression of surplus yearling leader growths, with a view to strengthening the leader system of the tree or any weak longitudinal section of it, and to maintain its symmetry. This should be particularly attended to when an orchard is growing on land under the average fertility. Secondly there is the "mid-season" thinning out or shortening back of strong upright surplus laterals, to encourage the development of weaker and more fruitful ones, where necessary, and also to admit light and air to all parts of the tree and to ripen the wood of the light laterals already produced. The third is the "late" pinching back of the yearling laterals to facilitate the more complete development of the fruit buds on the two-year-old wood below the lease of the yearling growths, when the tree arrives at the bearing age.

The terms "early," "mid-season," and "late" mentioned above in connexion with the three factors, mean the times during the currency of the vegetative period to be judged by the pruner as best suited according to circumstances, for the performance of the operations just detailed.

In consequence of the varying soil, climatic conditions, and the individual needs of the respective varieties requiring treatment in order to obtain the best results according to the object which it is desired to achieve, no definite time limit can be fixed for the operation of Summer pruning.

Speaking generally, however, the early treatment of the leader growths may be carried out as soon as the objectionable character of those requiring attention is observed during November. The mid-season thinning out or shortening back of the laterals may receive attention during December, and the late pinching back of the laterals requiring same may be performed during February.

Success or failure in this regard largely depends on the scientific pruning knowledge possessed by the operator and its expedient application

Almost all the varieties of apple trees in general cultivation, except when making exceptionally rank growth through growing on rich land, respond freely to ordinary winter pruning, and they may be made to bear reasonably heavy crops without difficulty, except in a few instances, where cross-pollination of varieties requiring same has not been provided for.

Owing to pruning science having advanced to the state of perfection at which we find it at present, the Summer treatment of trees has not been practised during recent years to nearly the extent that formerly obtained. Particularly on account of the stunting effect which it usually produces on the tree, as explained in the case of Plate 20, Figs. 2 and 3; Plate 22, Figs. 1, 2, and 3; and Plate 23, Figs. 1 and 2, Summer pruning is not advocated except when it assists in regulating the branch system while the tree is young, and thus helps to make the

laterals of rank-growing trees, as they arrive at the age of bearing, more fruitful.

Plate 77 shows a six-year-old Jonathan before its surplus leaders were thinned out in November.

Plate 78 is the same tree after the performance of the operation. Some pruners operate on the offending growths by simply bending down and fracturing them some little distance above the points at which it is intended to cut them during the succeeding winter pruning. But

Plate 77.—Jonathan, six years old, before thinning-out.

whether the complete or partial removal of the surplus growths be decided upon, the writer would prefer that at the Summer pruning the growths should be amputated at the points fixed upon. This would not only obviate the second operation of pruning off the fractured growths subsequently, but would also facilitate the healing of the bark at the points where the limbs were amputated.

The illustration represents a well-grown, nicely balanced tree, which, through careful pruning is, like the others in the same block, becoming highly fruitful. The soil on which it is growing is a fairly good

dark sandy loam, and owing to its thorough system of sub-drainage, good cultivation, and the regular incorporation in it of a liberal supply of stable manure, which best suits this class of soil, it becomes a congenial home, enabling the Jonathan to produce highly remunerative crops.

From the above a fairly clear inference may be drawn of the advantages to be derived from the practice of Summer pruning and the limited conditions under which it is advocated. Therefore, it will be realized

Plate 78.—Same tree as in Plate 77 after thinning-out.

that if the cardinal principles, governing the practice of Summer pruning, particularly those relating to the time of the operation, the quantity, nature, and substance of the wood to be removed, are not thoroughly understood, and the operation scientifically executed, incalculable damage may be done to the tree rather than that the desired advantages will accrue.

The next two illustrations are of Jonathan trees growing on good soil, but they are rather small and weak, owing to the area on which they were planted lacking perfect drainage, though it was kept well

cultivated. When trees are stunted in this manner, provided it does not affect them too seriously, they usually incline to fruitfulness, though rarely bearing remunerative crops. However, the pruner should be possessed of sufficient knowledge concerning the matter to know that trees growing under these conditions should not be Summer pruned. Yet it is frequently found that they are operated upon.

Plate 79 illustrates a tree eight years old, which for reasons already stated, made weak growths annually, until the last one was produced.

Plate 79.—Jonathan, eight years old, summer pruned, showing premature production of fruit and leader development.

For experimental purposes, this tree, while carrying a light crop of fruit, was Summer pruned on 10th December, 1914, and the method of treatment adopted in its case throughout, was similar to that indicated in the section, Plate 81.

By the 10th of January, 1915, short growths were produced, as a result of this cutting, and on these premature blooms were formed. These produced a light crop of fruit, which partly matured during the Autumn, and was still sound on the tree when photographed on 15th

July, 1915. As well as producing the fruit, rather strong wood growths were made on top. This was partly due to the cutting, but mainly on account of the perfecting of the drainage, during the winter preceding the pruning operation. This tree is now showing healthy development, and illustrates the advantages of perfect drainage.

Plate 80 shows a sister tree to that in the previous illustration, and it received similar Summer pruning. As a result of this it produced more fruit than did the previous tree, but as the drainage was allowed to remain in its original unsatisfactory condition the wood growths produced on top were light, although somewhat stronger than those made by it during the previous season of growth.

Plate 80.—Jonathan, same age as tree in Plate 79, treated similarly, showing more fruit, but less wood growth.

Plate 81 exemplifies an enlarged section of that portion of the leader above the place where it is marked (a) in Plate 80. This shows generally the method of treating the wood of the trees in Plates 79 and 80, and indicates more distinctly the results obtained.

This leader was Winter pruned at (a), (b), and (c) during the years 1912, 1913, 1914 respectively, and the portion above (c) is one year old. When the leader was cut at (c) in July, 1914, the three uppermost laterals were pruned too short at (d) in the then yearling wood. Being weak short laterals they should have been allowed to remain unpruned, so as to have built up their fruit buds, as previously explained,

during the growing period of 1914-1915, and then they would have blossomed and borne fruit during the 1915-1916 period of vegetation.

During the time the three uppermost laterals were being treated, and acting as described, the lower one extended from the terminal bud, which was situated at (d). On the 10th December, 1914, all four laterals had extended beyond this point, but were cut back to the points marked

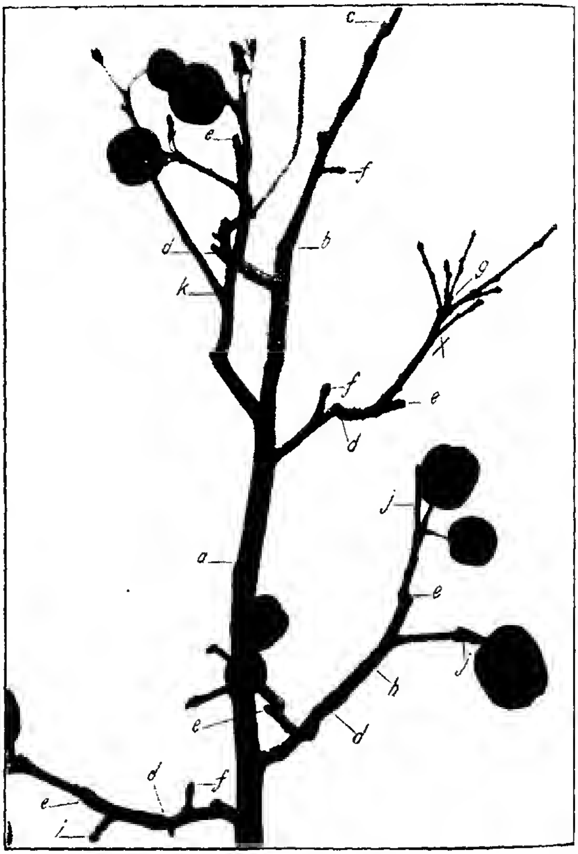


Plate 81.

(e). After being Summer pruned in this way three of the four laterals made short growths from one or two of the uppermost buds, in each case, below the points (e) on the soft young wood. Blossoms were developed on the terminals of the growths and on these fruit subsequently formed as shown. Although the growth (x), which is viewed from a

diff...nt position, but similarly marked in Plate 80, blossomed at (g), the ..en terminal bud, no fruit was developed. This enabled the grow..h to produce six short pieces of wood on the prematurely formed fru.t knob, each of which is similar in character to the single ones marked (j) on the fruited parts. Although these short growths appear fruitful they were, during the currency of the period of growth, unable to ripen their wood, and consequently are of a character which it is undesirable to ret.in as fruit-wood.

During the early spring after the uppermost yearling growth was Winter pruned at (d) the then leaf bud (k) partly developed into a fruit bud. However, when the soft young wood, produced during the currency of the period of growth above it, was cut at (e), (k) extended into wood growth, blossomed on the terminal, and fruited simultaneously with the other growths of like age, but growing on younger wood.

As a result of this Summer treatment of the section, the three natural fruit buds (f) did not burst into flower, but the portions of wood, which connect them with the parent two-year-old wood of the leader and laterals respectively, became somewhat more lengthened than is the case under ordinary conditions. Instead of remaining in the condition of a partly dormant leaf bud as usually happens in the case of those similarly placed on the yearling wood of the Jonathan, (h) has, through the (e) cut, been developed into a weak fruit bud which would probably open into bloom the following Spring. But fruit rarely sets on blooms of this character, particularly when they are situated too near the base of the yearling growth. The short growth (i) on the lowest lateral, was unable to make blossom and fruit like the corresponding growths on the other laterals, neither did it build up a blossom bud on its point for the succeeding year like the two-year-old buds (f). This is usually the work of the second year for late maturing growths.

Since fruit-growers and pruning experts here have become cognisant of the injury which may attend the growth of the trees, and the consequent limitation of their productiveness, often through the careless performance of the operation, but more frequently owing to the operator's imperfect knowledge of the practice, Summer pruning is now restricted to the narrowest limits, even in districts where it was hitherto most extensively practised.

The specimen, which forms the subject of illustratiou uow under review, was experimented with to show the possibility of causing a tree or section of it to prematurely produce its fruit, and from the experimentalist's point of view the results have been highly satisfactory. But, if all the trees in the orchard had been treated, year after year, like the ones operated upon, and had they responded similarly, which in all probability they would have done, it would mean absolute disaster to the orchardist.

With the detailed explanation given when treating of the Winter pruning of Jonathan laterals, the method of building up their fruit buds on the two year-old wood will be understood. Consequently, it will be observed that, if the growths made from (d), where pruned in July, 1914, had been retained whole, instead of their having been cut at (e) on the 10th December of the same year, they would have ripened their yearling wood during the 1914-15 period of vegetatiou. During the 1915-16 period of growth their leaf buds would have been converted into fruit buds. Under normal conditions these fruit buds would be in full bloom on the 10th October, 1916. This is the date registered for

the full bloom of the Jonathan in the Croydon district, where these trees are growing.

Now it will be observed that the result of the (e) cuts was the production from the buds, which in the natural course would have blossomed on 10th October, 1916, of short growths which bloomed on their terminal buds on the 10th January, 1915, or twenty-one months sooner than if the specimen was not Summer pruned.

Fruit, partly matured in this manner, out of season on deciduous trees, is rarely of any commercial value, and its production is consequently a waste of energy on the part of the trees. They also suffer considerable injury as a result of their partial defoliation through the action of Summer pruning during the currency of the vegetative period.

Plate 82.

The orchardist may assist Nature to a reasonable extent in the development of his trees, and in the production of fruit; but he must be prepared to suffer the penalty which she invariably inflicts for any serious transgression of her laws.

VICTORIA'S GENIAL CLIMATE.

It has been stated that the fruit, which appears on the trees in Plates 79 and 80, although only partly developed and lacking good flavour, was perfectly sound when the trees were photographed on the 15th July, 1915, or about five months after the seasonable crop was

picked, and three months before the trees would blossom again under normal conditions. The soundness of the late fruit may be attributed to the absence of heavy frosts, and low temperatures, and to the comparatively mild weather conditions which prevail throughout the year, in this State. The lack of good flavour and the cause of general imperfection otherwise of this unseasonable class of fruit, is due to its late setting on immature wood, and to the decay of the trees' foliage during the process of the fruit's development. Fruit, appearing on this class of wood as a result of the tree's early drastic Summer treatment, is often erroneously regarded by orchardists as having been produced from late blossoms, whereas, in reality, it is the production of prematurely developed fruit buds.

Late blooms are, correctly speaking, produced on fruit buds, built up during the previous period of vegetation, but these blossoms do not appear until after the recognised time for the regular flowering of the particular variety. The fruit on buds of this kind usually sets early enough, and owing to its growing on matured wood, it is enabled to mature during the ripening period.

The three specimens of spur growths with the fruit of 1915 attached, and also carrying the blossoms of 1916, as well as the one without bloom shown in Plate 82, afford further evidence of Victoria's genial climate. Figs. 1, 2, and 4 are the Reinette du Canada, Jonathan, and Sturmer Pippin varieties respectively. Fig. 3 is a Rokewood, but without blossom.

The fruit was produced under normal conditions on buds which were in full bloom on or about 10th October, 1915, as this is the date registered for "full bloom" of these varieties in the Tunstall district, where the specimens were grown. They were removed from the trees on 10th and photographed on 11th October, 1916.

Quantities of apples "wintering over" on the trees in this manner is by no means an uncommon occurrence. But, owing to the abnormally heavy crops of 1916, with a mild winter supervening, the amount of sound fruit, which remained on the trees, was much in excess of that present during any previous year.

A high percentage of the comparatively large quantity of fruit on the ground beneath the trees was also sound, when the specimens shown in the illustration were collected.

Fig. 1 (the Reinette du Canada) shows what usually happens in the case of this variety, when the fruit ceases to grow, but this was much more in evidence during 1916 than formerly. Frequently large numbers of apples, at various stages of growth, cease to develop, but, instead of falling off the trees, they cling tenaciously to the parent twigs, shrivel, and dry up. While in this condition the fruit often affords a safe harbour for the apple beetle (*Doticus pestilens*).

Figs. 2, 3, and 4, Jonathan, Rokewood, and Sturmer Pippin respectively, when photographed, were cut through and found to be perfectly sound. Closer tests, however, revealed the fact that they had parted with the good flavour and pleasing aroma which characterize these varieties.

SHELTERING THE ORCHARD.

Throughout Victoria, whether established on level, or undulating lands, orchards generally require protection from prevailing winds.

On flat country, where the plantation sites are not afforded natural immunity from these winds through belts of forest growths, wind-break hedges should be planted.

In undulating districts, however, it happens that elevations, whether reclaimed tablelands, or virgin arboreous declivities, often lend themselves as a protection against winds to the planted areas. Where natural protection of this kind does not obtain in these districts shelters should be provided.

The advantages which accrue from the sheltering of the orchard are manifold. Shelter protects the blossoms during the expanding and fertilizing period, from chilling winds. A normal temperature at this stage facilitates pollen germination; it is advantageous to the setting of the fruit and assists in the process of fertilization generally. Strong wind striking the blooms, particularly if they are in a moist condition, as frequently happens during the time of flowering, has the effect of lowering their temperature. To prove the correctness of this assertion the orchardist has only to dip his hand in water, and then even on a warm day, pass it swiftly through the still air. However, the local lowering of temperature in this way has a relatively greater effect on animal than on plant life.

The result of the work done by bees and other helpful insects in the distribution of pollen is of incalculably greater advantage to the orchardist, than that performed by the wind, even when it is not too strong and cold. In the sheltered, warm parts of the orchard, the setting of fruit and its subsequent retention on the trees is invariably more satisfactory than it is on the bleak, wind-swept portions.

When the weather conditions are favorable during the blooming period, and until the fruit is set and thoroughly established, strong cold winds frequently supervene, and where protection from them is not provided, a high percentage of the young fruit becomes chilled, in the manner described in connexion with the blooms, turns yellow, loses its hold on the tree, and falls to the ground.

Hail, when carried by strong wind through exposed orchards, does considerably more injury to the young fruit than it inflicts on that where the wind is partly stilled through the agency of effective shelters.

Shelters prevent hot winds in many instances, blowing off considerable quantities of ripe fruit from the trees. These winds are also checked in their work of depleting the surface soil of the moisture brought up by capillary attraction.

If permitted to enter the orchard area with full force, strong winds cause young trees to "wobble," and if not supported by stakes their establishment on solid lines frequently proves a difficult proposition. On exposed positions the wind is often the cause of older trees splitting at the crown, but, when they are sheltered, this is prevented, and the trees' superstructures are preserved intact.

In spraying for Codlin Moth, Black Spot, &c., under these favourable conditions, the amount of spray mixtures used may be reduced to a minimum, and the work is more easy and efficacious.

Belts of native timbers with undergrowth, as a rule, afford the orchardist the most perfect protection against winds. When available for this purpose these forest trees mostly consist of the commoner native gums and wattles, but when artificial break-winds are being provided for he rarely brings these into use, although they are extensively employed on large farms and on stations as shelters for stock.

When the orchard slope is abrupt, unusually exposed, and when high shelter is required on the lower side Elms (*Ulmus*). Oaks

Plate 83.—Sugar Gums (*Eucalyptus corynocalyx*).

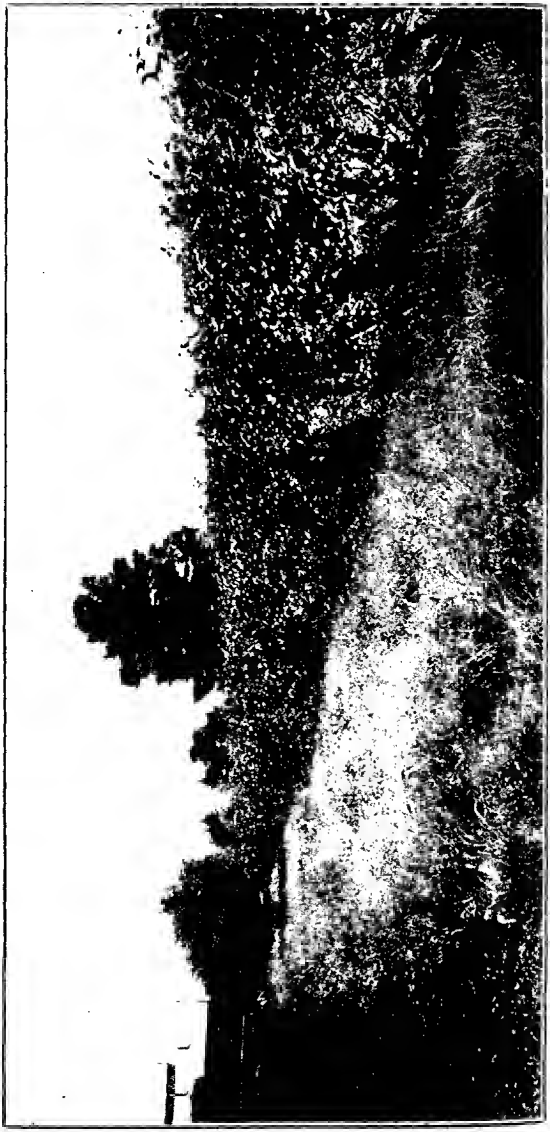


Plate 84.—A Young Sugar Gum Hedge.

Plate 35.—**Pittosporum** (*Pittosporum undulatum*).

Plate 86.—Acacia (*Acacia armata*).

Plate 87.—*Pinus insignis.*

Plate 88.—*Pinus insignis,* sheltering the Fruit Trees.

Plate 89.—Cupressus (*Cupressus Lambertiana horizontalis*).

(Q. *ercus*), and Oriental Planes (*Platanus orientalis*) are occasionally planted to prevent the winds sweeping up the slope. These trees are, however, more suitable for street and park planting as decorative sun-shades.

Evergreens are as a rule more suitable for orchard shelters than deciduous trees, as the latter are rarely in leaf early enough to protect the blossoms of the fruit trees, and this is one of the most important functions of the break-wind.

The accompanying illustrations show some of the break-winds in most general use.

Plate 83 shows a well-grown Sugar Gum (*Eucalyptus corynocalyx*) hedge. It is a free grower, and thrives well under our various soil and climatic conditions. This hedge runs east to west, and shelters the orchard mostly from north winds. The Sugar Gum makes a first-class break-wind, and is quickly coming into prominence as such.

Plate 90.—Cherry Plum (*Prunus cerasifera*).

If left to its own resources while young, however, the hedge will be rather open near the ground as may be observed in the illustration under review.

Plate 84 illustrates a young hedge of the same variety, and the method of cutting back the trees, for a few years, while they are young, is indicated. After the hedge has thickened near the ground in this manner, it requires no further attention, and the result usually is all that can be desired.

Plate 85 is Pittosporum (*Pittosporum undulatum*), which affords good shelter. It likes fairly rich, moist, but well-drained land. Like the Sugar Gum, it grows freely from seed, and requires but little trimming as an orchard shelter. Its range of usefulness, as a break-wind, is considerably restricted on account of its antipathy to poor dry soils.

Plate 86 is prickly Acacia (*Acacia armata*). This, being a hardy dense, rapid-growing, indigenous shrub, makes a splendid shelter, which

may be kept shapely with a little attention. It thrives well under all conditions, but its great fault is that it offers a safe domicile to sparrows, starlings, and other pests, which often cause considerable loss to the orchardist through the destruction of large quantities of his fruit. This hedge runs north to south, and does good service to the orchard by protecting it mainly from westerly winds.

Plate 87 shows a row of large Pines (*Pinus insignis*) sheltering the orchardist's home from westerly winds, as the trees extend north to south. When necessary to combat strong winds in open situations it is difficult to find a better tree barrier than *Pinus insignis*, and its scope of usefulness in Victoria as a shelter tree is unlimited, owing to its adaptability to such a wide range of soil and climatic conditions. It is a free-grower, and may be easily raised from the seed.

Plate 88 is also *Pinus insignis*, but shown as sheltering the fruit trees. When large shelter trees are used, they should be planted at least 20 feet away from the nearest row of fruit trees. And when their roots extend into the area occupied by the fruit trees, a trench should be dug about 6 feet away from the break-wind, and deep enough, to permit of the operator bisecting the roots, which, if permitted to remain intact, would rob the fruit trees of the food so essential to their profitable cultivation. This operation may be repeated as often as occasion requires. Thus the shelter trees are obliged to search for their food in the opposite direction. The trench may then be filled in, should the headland not be wide enough to permit of cultivation being carried on, or it may be left open to carry away the surface drainage.

Plate 89 is Cupressus (*Cupressus Lambertiana horizontalis*). This, on account of its well-known decorative beauty, combined with its unquestionable utility as a shelter hedge either for city gardens or for orchards, is, in the opinion of the writer, the best of all our hedging trees. As an orchard shelter the trees may be planted from 6 to 10 feet or more apart in the row. When they reach about 10 feet in height, the centres may be removed so as to cause the trees to spread, or they may be allowed to assume their natural shape as shown in the illustration. These trees grow freely from cuttings, and this is the usual method employed in their propagation. They may be raised from seeds, but only a small percentage of the young trees are endowed with the good characteristics of the parent.

Plate 90 is Cherry Plum (*Prunus cerasifera*). This is the best known, and was until recent years, perhaps, the most extensively grown of the artificial break-winds. The tree is a hardy, vigorous grower, and payable prices are often obtained for the fruit. The Cherry Plum, although deciduous, blossoms and comes into leaf earlier than the Apple. This, supplemented by its usual density, generally affords a protection to the Apple during its blooming stage. For these reasons the Cherry Plum makes a very good double-purpose hedge.

Tree Lucerne (*Cytisus proliferus*) makes one of the best shelters on light drifting sandy soils. It is a rapid grower, and provided the sub-soil is fairly rich in plant food, the Lucerne will thrive well and quickly develop into a substantial break-wind.

Quinces, Chestnuts, Walnuts, English Holly, English Laurel, and Hawthorn, are used as shelters, but those figured in the illustrations give most satisfaction.

(To be continued.)

ARTIFICIAL FERTILIZERS.

Pre-War and War Cost.

By W. C. Robertson, Supervising Analyst.

Events of recent years have had a decided influence on the price of artificial fertilizers in Victoria.

This paper deals with the average prices of the various fertilizers in common use, and the brands of which have been registered at the office of the Director of Agriculture during the past six years, viz., 1912-1917. Occasional reference is made to the prices in 1907.

Superphosphate.

The most popular and important artificial fertilizer supplied to the Victorian agriculturist is superphosphate. Probably from 85 to 90 per cent. of the artificial fertilizers used in Victoria consist of superphosphate, and the whole of this is of local manufacture. During the years prior to 1912 a fair amount of superphosphate was imported. In 1912-13 importations practically ceased, whilst absolute cessation followed the outbreak of the present lamentable war. The raw materials used in the manufacture of superphosphate are rock phosphate and sulphuric acid. The former is obtained from islands in the Pacific Ocean, whilst the latter is manufactured at the manure factories by burning sulphur or iron pyrites in a highly technical manner, and then, after complete oxidation, the resultant gas is absorbed in water and the liquid concentrated, if need be. During the war, freights have become abnormal, and naturally the price of the raw material, sulphur, has increased. One would expect an increase in the price of iron pyrites also; but judging from the lists of registered brands there has been no rise in the price of rock phosphate. Probably this raw material is bought under contract.

Calculating from the average price and average guarantee of the various brands of superphosphates registered for the current season the farmer is to receive **79** lbs. of water soluble phosphoric acid associated with **4.6** lbs. of phosphoric acid in the citrate soluble and citrate insoluble forms in return for every **20**s. expended in the purchase of superphosphate.

During the years 1913-14-15 the farmer received approximately **87** lbs. of water soluble phosphoric acid and **14** lbs. of phosphoric acid in the other forms in exchange for every **20**s. shown on the superphosphate bill.

It will therefore be seen that the purchasing power of the sovereign, as far as the purchase of superphosphate is concerned, has declined during the years 1915-17.

During the year 1907 the farmer received **103.5** lbs. of water soluble phosphoric acid together with **8.5** lbs. of citrate soluble and citrate insoluble phosphoric acid in return for **20**s. expended in the purchase of this fertilizer. (See this Journal 10th February, 1913, pp. 97.)

This means that **20**s. had a purchasing power in 1907 that **26**s. **6**d. has in 1917.

An increase in the pounds of phosphoric acid forms other than water soluble received is shown during the years 1907-13, but the years 1915-17 show a noted decline until the 1907 figure of 8.5 lbs. is decreased to 4.6 lbs.

The following table will probably illustrate more clearly:—

THE PURCHASE OF SUPERPHOSPHATE.

Year.	Amount expended.	Weight in pounds received. Water solubles phosphoric acid.	Weight in pounds received. Phosphoric acid in other forms.	Percentage decrease, water soluble phosphoric acid.	Percentage decrease, phosphoric acid in other forms.	Percentage increase, phosphoric acid in other forms.
		lbs.	lbs.	%	%	%
1907 ..	20/-	103·5	8·5	..	..	..
1913 ..	20/-	87·0	14·0	16.	..	64·7
1917 ..	20/-	79·0	4·6	9·2	67·1	..

A reference to Graph No. I., which appears on page 297, will give additional particulars in regard to the purchase of superphosphate during the years 1912-17.

The pillar column on the extreme left of the graph depicts the number of pounds of phosphoric acid in the three forms received in return for 20s. expended in the purchase of "super" during the period under review.

The numerals at the foot of the pillar column denote the year, the unshaded portion serves to illustrate the pounds of water soluble phosphoric acid received, whilst the one-way shading denotes pounds of citrate soluble phosphoric acid, and the cross shading the pounds of citrate insoluble phosphoric acid.

It will be noted that the year 1916 shows a fall in the grade of the fertilizer, and the year 1917 shows both a fall in grade and an increase in price.

SODIUM NITRATE.

The most readily available form in which the essential plant food nitrogen may be purchased is in the form of nitrate as sodium nitrate—more commonly known as nitrate of soda—a term which is not strictly correct.

This fertilizer is imported from abroad, viz., from Chili, and naturally one would expect war increase in the price of sodium nitrate.

A reference to the second diagram on Graph I. appended will disclose the number of pounds of nitrogen received in exchange for every 20s. spent by the farmer in the purchase of sodium nitrate during the past six years.

The vertically shaded pillars denote the number of pounds of nitrogen, the figures giving the number of pounds received in the various years which are set out at the foot of each pillar.

The grade of this fertilizer shows no variation, but the price has risen. In 1912 sodium nitrate could be purchased at £13 10s. per ton. In 1913 a rise took place, the average price being £14 9s. per ton. This price held within 1s. during the years 1913, 1914, 1915,

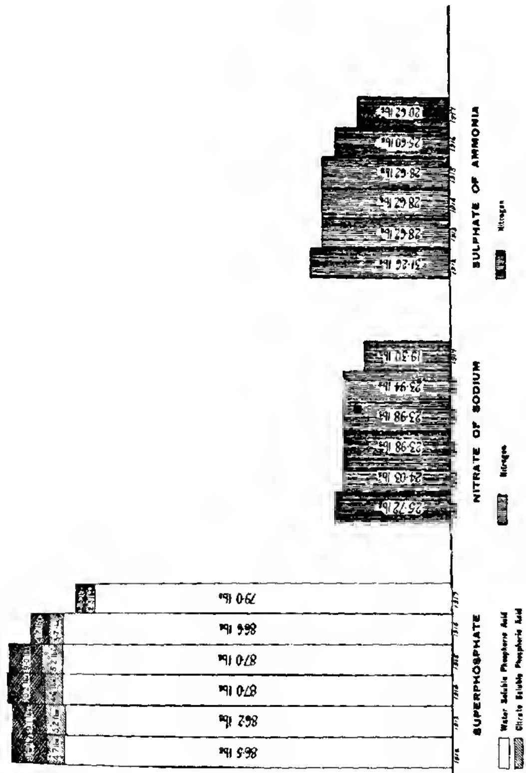


Diagram showing pounds of phosphoric acid received for twenty shillings.

Diagram showing pounds of nitrate nitrogen received for twenty shillings.

Graph I.

Diagram showing pounds of ammoniacal nitrogen received for twenty shillings.

and 1916, but the current year 1917 shows an advance to £18 per ton.

Twenty shillings spent in the purchase of sodium nitrate in 1912 obtained an amount of nitrogen for which the sum of 26s. 7d. would have to be paid during the current season—in other words, the purchasing power of the sovereign has declined approximately 25 per cent.

AMMONIUM SULPHATE.

Ammonium Sulphate supplies nitrogen in the form of ammonia. It is produced as a by-product in the manufacture of coal gas, the method being to treat the ammoniacal liquor obtained during the destruction distillation of the coal and the subsequent washing operation to which the gases are subjected, with sulphuric acid, when the compound ammonium sulphate is formed. The latter after evaporation is collected in the crystalline form, and in this state is placed on the fertilizer market.

All the sulphate of ammonia used in Victoria is of local manufacture—as a matter of fact, the demand not being equal to the supply, a fair amount is exported annually.

Graph I. shows on the extreme right a diagram depicting the number of pounds of nitrogen received in the form of ammonium sulphate in exchange for 20s. during the years 1912 to 1917.

The diagram explains itself. Suffice it to say there was a rise in the price of this manure in 1913, which held until 1916, when a further increase will be noted; whilst the current season has been favoured with another marked advance in the price.

The increased cost of this manure may be due to (*a*) increase in wages, (*b*) increased cost of the raw materials—coal and sulphuric acid. One more example of "the farmer pays."

Computing from the ammonium sulphate diagram shown on Graph I., we find the purchasing power of the sovereign has declined to 13s. 3d. during the years 1912 to 1917.

In 1912 the farmer received 31.62 lbs. of ammoniacal nitrogen in exchange for 20s. During 1917 the sum of 30s. 4d. will have to be paid to obtain the same amount of ammoniacal nitrogen.

DRIED BLOOD.

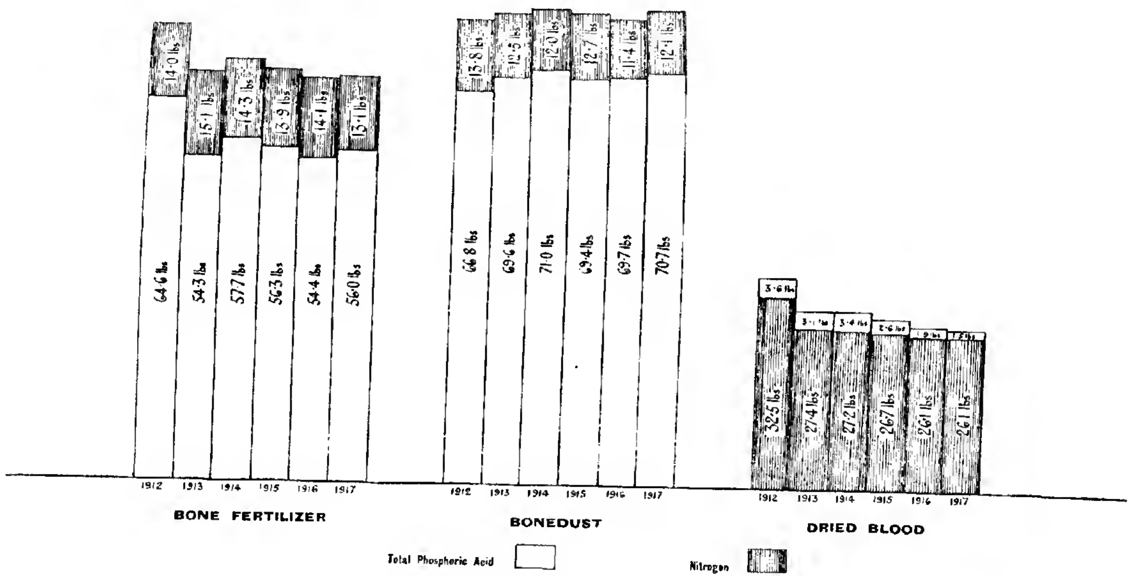
This fertilizer is manufactured or prepared by the simple process of drying, usually by means of hot air. All brands are of Australian manufacture, mostly Victorian, but some are prepared in other States.

The diagram on the extreme right of Graph II. appended shows the number of pounds of nitrogen and phosphoric acid received for 20s. in the purchase of dried blood during the period under review.

The diagram shows a decline in the pounds of phosphoric acid received, but particular notice need not be taken of this fact, because this manure is essentially a nitrogen fertilizer, and in some instances manufacturers do not bother to quote phosphoric acid.

The diagram shows a gradual decline in the number of pounds of nitrogen received.

32.5 lbs. were received in exchange for 20s. in 1912, whereas only 26.1 lbs. are offered in exchange for the same monetary consideration during the current season.



Graph II.

Diagram showing pounds of Phosphoric Acid and Nitrogen received for twenty shillings.

Twenty shillings spent in the purchase of **Dried Blood** in **1917** wi only have the purchasing power that **16s.** had in **1912.** In other word, nitrogen purchased as dried blood in **1912** for **20s.** would cost the su of approximately 25s. in **1917.**

BONE DUST.

The central diagram on Graph II. relates to the purchase of Bone dust. Attention is drawn to the fact that the computations are based on the main list of registered brands. This procedure was necessary for the sake of comparison in that the 1916-17 supplementary registrations are not available.

Bone dust is, or should be, the product obtained by grinding or disintegrating bones or recent animal matter. This fertilizer is the product of local industry.

Small parcels were obtained from other States, viz., New South Wales and Queensland, in bygone years; but, as a matter of fact, a fair amount of bone dust in the adulterated condition, *i.e.*, "bone fertilizer," annually finds its way out of Victoria.

The process of manufacture is simplicity in itself. The bones are in the first place subjected to steam pressure in a digester for the dual purpose of extracting the tallow and softening the bones. The latter are then discharged from the digester and ground in a mill or disintegrator, of which there are several kinds in use.

The bone dust diagram previously referred to shows the price of bone dust to be fairly constant during the period under review. However, computing from 1907 over a period of ten years, we find that bone dust has increased in price. In **1907** **8·1 lbs.** of phosphoric acid, together with 13.5 lbs. of nitrogen, were received for every **20s.** expended in the purchase of bone dust, whereas in **1917** for the same monetary consideration only **71 lbs.** of phosphoric acid and **12 lbs.** of nitrogen are obtained.

Roughly, this increase in price is 15 **per cent.**

BONE FERTILIZER.

The term "bone fertilizer" is strictly Victorian. The manure is a mixture of bone dust with either rock phosphate, gypsum, marl, superphosphate, or any such material.

Some brands may contain a proportion of each of the foregoing materials, and in many instances the proportion of bone dust is so small as to be hardly discernible.

The diagram on the left of Graph II. shows the amounts of phosphoric acid and nitrogen received in exchange for 20s. in the purchase of bone fertilizer during the past six years.

The graph explains itself, but it is interesting to note the decline in the amount of phosphoric acid in the years subsequent to 1912 and the decline in the pounds of nitrogen received in 1917.

The increase in the price of bone fertilizer over the period 1912-17 is approximately **10 per cent.**

MISCELLANEOUS.

There are other brands of fertilizers on the market. Some are r rely, if ever, used by the farmer.

Concentrated superphosphate is an imported article. Throughout the period 1912-16 it was obtainable at £12 10s. per ton, but this year the price has been advanced 8 per cent., viz., to £13 10s.

For rock phosphate—the raw material used in the manufacture of "super"—contract rates still rule, but the shortage of shipping has seriously interfered with the amounts available, and shipping rates are abnormally high.

The imported manures—Thomas' phosphate, potassium sulphate, potassium chloride, and kainit have disappeared from our markets.

Potassium fertilizers have proved themselves of value in potato and onion cultivation, and also in horticulture.

They occur as natural deposits in certain parts of Germany, notably Stassfurt, and owing to the extent of these deposits and the ease in which they are mined and worked, economic conditions preclude successful competition.

Naturally, capital invested in the successful artificial production of potassium fertilizers would return a handsome rate of interest during the war, but it would be in a sorry position when the guns ceased booming.

It is highly probable that the Victorian producer will have to farm without the assistance of potassium fertilizers until the end of the war.

Until then he will have to rely (*a*) on the application of wood-ashes which contain from 1 to 10 per cent. potash (bracken fern ash will contain 10 per cent.; (*b*) on heavy dressings of lime and gypsum, which react with minerals in the soil, whereby potash is liberated by replacement; or (*c*) on a wide rotation to conserve as much of the potash already existing in the soil.

Orchardists, of course, will have to resort to the methods indicated in (*a*) and (*b*).

Thomas' phosphate is not an essential fertilizer for successful farm practice in Victoria, but those who have been in the habit of applying this fertilizer with good results to heavy soils may substitute an early autumn dressing of lime prior to sowing with "super."

Other manures on the market, such as "bone and super," "nitro-super," &c., show a proportional increase in price. This follows, of course, the increase in price of the parent fertilizers used in the admixture

CONCLUSION.

This paper has in the main dealt with the prices of fertilizers during the years 1912-17. The following table, which embraces the pre-war and war increases, reveals the situation at a glance.

Fertilizer.	Pre-war increase, 1912-14.	War increase, 1914-17.	Total increase.
	%	%	%
Sodium nitrate	7	25	32
Ammonium sulphate	9	39	48
Superphosphate	Nil	12·5	12·5
Concentrated superphosphate ..	Nil	8·0	8·0
Dried blood	21·25	5·0	26·25
Bone dust	Practically nil	Practically nil	Nil
Bone fertilizer	3	6	9

If we go back to 1907 and compute the percentage increase in price over a period of ten years, we find the following:—Bone dust 15 per cent., superphosphate 28 per cent., dried blood 38 per cent., sodium nitrate 36 per cent., ammonium sulphate 56 per cent.

The wheat farmer has certainly received a higher price during the war for his wheat, but this is not so apparent in the case of oats, barley, potatoes, and onions—drought year excluded. Higher prices have certainly been received for beef, lamb, mutton and wool, but only a small percentage of these increases can be accredited to artificial manuring.

The fact remains the farmer is at present paying increased prices for artificial fertilizers, but he may possibly find the bird returning to its nest after the war. Let us hope so.

EAR-MARKING OF SHEEP AND CATTLE.

Limitations Imposed by South Australian Legislation.

By F. R. Temple, Stock Inspector.

The Government of South Australia prohibits the introduction into that State of what is known as cropped-eared sheep and cattle, and seeing that South Australian buyers of stock (especially sheep) will not purchase stock in Victoria if the ears of the animals are not in accordance with the requirements of the regulations of their State, stock-breeders should be made aware of what really constitutes "cropped ears" in the neighbouring State. A cropped ear on stock in South Australia is not only that which in Victoria is understood as an ear cut square across, but comprises a definite amount of mutilation allowed, which is as follows:—

Clause 51, section B, of the South Australian Brands Act—In the case of sheep, no ear mark shall exceed three-quarters of an inch in length or half an inch in width or diameter, unless such an ear mark is a slit, which may be 1 inch and a quarter in length from the tip of the ear (the tip being the only point specified from where a slit can commence), and in no case, either of cattle or sheep, shall an ear mark be made by means of a crop.

Section 60E provides that any person who has in his possession any cattle or sheep with its ear mark contrary to the provisions of section 51, or in the case of cattle with any part of the dewlap cut off, shall be guilty of an offence against the Act, &c.

My desire in drawing attention to this matter is to point out to our graziers the loss of would-be South Australian purchasers through a want of knowledge of these matters as on several occasions I have known where prospective buyers have declined business through this fault, where otherwise the animals would have been saleable at shillings per head more than could be obtained here.

BEE-KEEPING IN VICTORIA.

By F. R. Beuhne, Apiculturist.

XXVI.—THE HONEY FLORA OF VICTORIA—*continued.*

(Continued from page 116.)

THE MANUKA (*Leptospermum scoparium*).

(Figs. 64 and 65.)

Of the seven species of Leptospermum found in Victoria the Manuka is the most widely distributed. Manuka is the aboriginal name, but it is known in the bush as Tea-Tree, Ti-Tree, and Wild May. It is a rigid, very much branched shrub, and the young shoots have generally a silky appearance. In alpine situations it is sometimes low and almost prostrate, but more usually erect and attaining occasionally to a height of 12 feet. The leaves are from egg-shaped pointed to narrow-lance shaped, sharply pointed, and generally under ½ inch long. The adult foliage is usually smooth and hairless. The flowers are white, stalkless, and occur singly in the axils of leaves or terminating short lateral branchlets in the case of forms flowering early in the season (Fig. 64), while in late districts the flowers are well down below the new leaf growth (Fig. 65), so that the two forms give the impression of being two distinct species. There is also great variation in the shape and size of the leaves of this species in different localties, and as the different species merge into one another they are very difficult to distinguish. From the apiarist's point of view, however, there is little difference between the species, the honey from all of them having the same characteristics. The Manuka is common in Victoria in heathlands and moist situations. It flowers according to locality in October, November, December, January, and February, Fig. 64 representing it up to December. The forms flowering in January and February are shown in Fig. 65.

THE COAST TEA TREE (*Leptospermum lævigatum*).

This is the common Tea Tree, plentiful in the sandy country along the sea shore: it is, however, also found inland. In size it ranges from a shrub to a small tree attaining a height of 20 to 30 feet.

The leaves are oblong, broader at the end, or narrow, oblong, and blunt ended ½ to ¾ inch, but sometimes 1 inch long, more or less visibly three nerved. The foliage has a dull appearance. The flowers are white, and rather large in comparison with the other species. They are stalkless and occur at shoulders, singly, and on rare occasions two together, on a short common stalklet. The fruit is five to ten celled, and almost flat topped.

The Coast Tea Tree is useful in binding loose sand and when closely planted makes a good hedge; it flowers in September and October, and is the cause of the strong flavour of honey from hives near the sea side.

THE WOOLLY TEA TREE (*Leptospermum lanigerum*).

A tall shrub, sometimes growing into a small tree, rarely low and bushy. The branchlets and the underside of the leaves usually beset

with short, silky hairlets, hence, both the vernacular name "Woolly Tea Tree," and the specific "lanigerum" signifying woolly.

The leaves are from ovate oblong to elliptical or narrow oblong, very variable in size and shape, normally not above ½ inch long. In some varieties the leaves are all very much smaller, but in some luxuriant specimens they are ¾ inch long, or even longer, more or less hoary-silky, or hairy on the underside, or on both sides; but rarely totally hairless. The leaves when broad and thin show one, three, or five nerves. More frequently, however, they are thick leathery, and the nerves scarcely visible.

The flowers are solitary on short leafy branchlets or sometimes on the branches, stalkless, and without intervening leaves, white and often rather large. This variety of tea tree flowers in October, November, January, and February, according to locality. The wood is hard and heavy, and was used by the aborigines for making spear handles. The Woolly Tea Tree is found in all parts of Victoria, particularly in Gippsland, mountain districts, and the neighbourhood of Melbourne.

THE TANTOON (*Leptospermum flavescens*).

Usually a tall shrub, attaining a height of 8 to 15 feet, with a stem diameter of 5 to 8 inches. The wood is hard, and close grained. Its leaves are from narrow oblong to narrow lance-shaped, broadly oblong, or even broader at the end than at the base, blunt ended or scarcely pointed, ¾ inch long in the largest forms, but usually under ½ inch, and sometimes all very small. The leaves are generally smooth, rigid, flat, and nerveless, or one

Fig. 64.

or ... e nerved, the young parts minutely silky. The flowers are white or ... times turning slightly yellowish; they occur singly at the end of branchlets, or at the shoulders of leaves, and almost stalkless. The fruit is hard, quite convex at the summit, and usually five celled.

Fig. 65.

The Tantoon is found in the Buffalo Range, and on the Yarra, Goulburn, and Ovens Rivers.

THE MYRRH TEA TREE (*Leptospermum myrsinoides*).

(Fig. 66.)

A somewhat dwarf species, bushy and rather ornamental, with white or somewhat pinkish flowers. In habit it sometimes approaches the Manuka (*L. scoparium.*), but the leaves are not so sharp, sometimes ½ inch long, but generally less, oblong linear or broader at the end,

Fig. 66.

blunt ended, rigid, and concave. The flowers are small, white, or pinkish, almost all on very short, leafy branchlets, often several flowers together. This species is common in healthy tracts in the western districts, the north-west, the Wimmera, and the Snowy River. In most localities it flowers in September and October.

THE MYRTLE TEA TREE (*Leptospermum myrtifolium*)

A tall shrub, attaining a height of 8 to 10 feet, but flowering already when only 1 to 2 feet high. The branches are usually slender, smooth, or silky, the leaves generally small, and rarely ½ inch long, oblong, or broader at the end flat or hollow on the surface, nerveless, or one or

three nerved, and either smooth or silky white. The flowers are of medium size, all or nearly all occur singly at the ends of short leafy branches, and are stalkless. The wood is dark in colour, tough and close grained. The Myrtle Tea Tree is found in the Grampians, and flowers in November.

The Slender Tea Tree (*Leptospermum attenuatum*).

A leafy shrub, favouring moist situations, chiefly in the East and North-East. The branches are usually slender. The leaves are mostly narrow oblong, ¼ inch broad, and up to about 1 inch long. Generally the flowers are small, with calyx and stalklet, somewhat clothed with shining grey hairlets. The flowers occur either singly, or two together, on leafy branchlets on short stalklets.

The Slender Tea Tree grows on the Avon, Mitta Mitta, Ovens, and other eastern rivers.

(To be continued.)

VICTORIAN WHEAT HARVEST.

Return Compiled by the Government Statist showing Actual Area and Yield for the Seasons 1915–16 and 1916–17.

Counties.	Area in Acres.		Produce in Bushels.		Average per Acre in Bushels.	
	1915–16.	1916–17.	1915–16.	1916–17.	1915–16.	1916–17.
Grant ..	21,241	25,468	421,775	369,745	19·86	14·51
Talbot ..	27,659	21,794	555,143	390,738	20·07	17.93
Grenville ..	41,153	40,213	866,497	443,991	21·06	11·04
Hampden ..	28,218	31,216	597,211	356,277	21.16	11·41
Ripon ..	84,202	74,491	1,816,962	993,144	21·58	13·33
Lowan ..	245,654	179,678	4,123,207	3,221,407	16·78	17·93
Borung ..	540,588	377,319	10,417,851	8,485,152	19·27	22·49
Kara Kara ..	204,592	149,700	3.961,735	2,912,951	19·36	19·66
Weeah ..	222,972	232,409	2.733,097	3,384,045	12·26	14·56
Karkarooc ..	608,873	595,041	6,454,452	8,793,665	10·62	14·78
Tatchera ..	442,382	415,376	4,464,386	6,563,338	10·09	15·80
Gunbower ..	67,785	63,365	1,039,108	1,007,076	15·33	15·89
Gladstone	176,646	143,547	3,169,007	2,742,139	17·94	19·10
Bendigo ..	206,309	183,847	3,956,310	3,145,898	19·18	17·11
Rodney ..	186,466	150,018	3.756,512	2,203,710	20·15	14·69
Moira ..	426,410	308,378	7,623,010	4,454,077	17·88	14·44
Delatite ..	24,971	19,445	412,773	224,276	16·53	11·53
Bogong ..	60,460	47,024	979,887	520,379	16·21	11·07
Remaining Counties ..	64,390	67,363	1,172,783	920,430	18·21	13·66
Grain ..	3,679,971	3,125,692	58,521,706	51,162,438	15·90	16·37
Hay ..	333,449	195,532	..	..	..	..
Total ..	4,013,420	3,321,224	..	..	..	..

Note.—The requirements for seed and consumption in 1917 are estimated at about 10,000,000 bushels.

TWO DESTRUCTIVE INSECT PESTS OF PLANE AND ELM TREES IN VICTORIA.

By C. French, Jun., Government Entomologist.

In addition to fungus diseases, many of the elm and plane trees growing in the public parks, gardens, and streets are affected with insect pests, one of the worst being the "Cherry Borer Moth" (*Maroga gigantella*, or sometimes called *Cryptophasa unipunctata*).

The caterpillar bores within the limbs of plane and elm trees, and protects the outside of its tunnel with a covering of web, gnawed bark and droppings. If numerous, the trees are seriously injured. The caterpillar is a pinkish-white insect, hairy, with a black head, and, when full grown, about 2 inches in length. The perfect insect is white, shining, front of head and antennae black; forewings, in some instances, more or less greyish, the whole wings having a somewhat silky appearance with a black spot on each; hind wings darker. The moth is about the size of the well-known vine moth Phalaenoides (*Agarista*) glycine.

The larvæ of this moth destroy the trees by first tunnelling for some distance under the bark, and then gnawing their way right into the very heart of the tree. The sawdust-like excrescence on the trees being quite sufficient indication of the presence of borers in general, and this one in particular.

Prevention and Remedies.

Clear away the sawdust-like matter, the removal of which will indicate the direction taken by the grub. Remove as much of this material from the tunnel as possible, then soak a piece of rag or wadding in carbolic acid, plug this into it and close over with clay or soap. Another plan which is adopted is to probe the tunnel with a piece of strong wire, and in this way the grubs are often reached and destroyed. Spraying the trees with tar-impregnated water is also beneficial. The formula for coal-tar water is as follows:—Boil 1 lb. of coal-tar in 2 gallons of water, and while hot add from 50 to 100 gallons of water. Strain well before using.

The larvæ of the "Painted Apple Moth" (*Teia anartoides*) is becoming a serious pest to plane, elm, and other street trees. This insect formerly fed on the leaves of various acacias (wattles), but like many of our native insects has attacked other trees, causing much damage to same. The caterpillars of this moth usually eat the young foliage of the trees. The female moth is a short-rounded creature destitute of wings. Her life-work is very limited, as she simply crawls out of her shelter, lays her eggs on top of it, and then dies. The male moth has brownish upper wings with three whitish dots on each wing; underwings, the upper portion yellow, the lower portion black or dark-brown. The caterpillars are brownish, and are thickly clothed with long hairs, with two singular reddish-coloured appendages projecting from the back near the tail.

Remedy.

Spray trees with arsenate of lead, 1 lb. to 25 gallons of water.

Painted Apple Moth (reproduced from Handbook of the Destructive Insects of Victoria, by C. French, senior).

Fig. 1.—Apple branch, showing larvæ in various stages. Natural size.
Figs. 2 and 3.—Perfect insect, male. Natural size.
Fig. 4.—Perfect insect, female. Magnified.
Fig. 5.—Cocoon, eggs and perfect insect, female. Natural size.
Fig. 6.—Perfect insect, female, dorsal view. Natural size.
Figs. 7, 8, and 9. Pupa of male. Natural size.

Cherry Borer Moth (reproduced from Handbook of the Destructive Insects of Victoria, by C. French, senior).

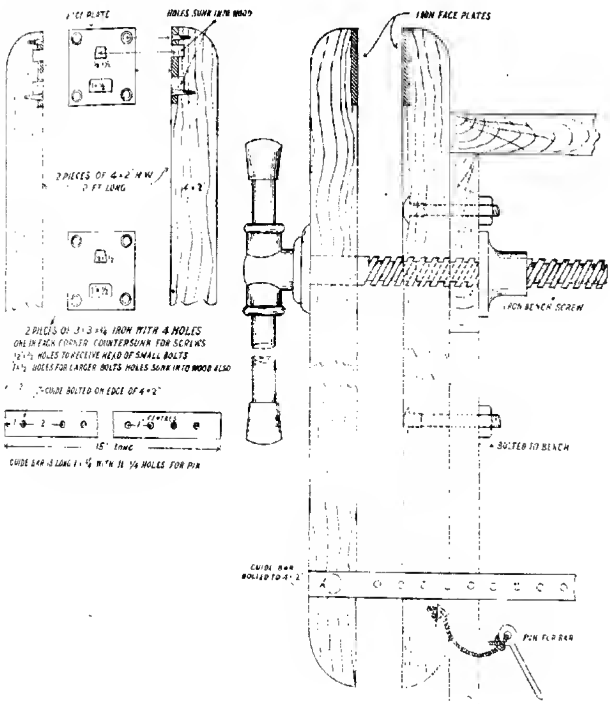
Fig. 1.—Cherry branch attacked by borer, appearance of sawdust-like covering, indicating grub at work.
Fig. 1a.—Branch, with covering removed, showing damage done by larvæ
Fig. 2.—Larva in bore, where it retires when not feeding.
Fig. 3.—Larva (or grub), top view. Natural size.
Fig. 3a.—Larva (or grub), under view. Natural size.
Fig. 4.—Head and first three segments of larva, side view.
Fig. 4a.—Head and first three segments of larva, ventral view.
Fig. 5.—Perfect insect. Natural size.

HANDY FARM DEVICE.

THE BENCH VICE.

By J. J. Ricketts, Dairy Supervisor.

An article which should be on every farm is a bench vice suitable for holding both wood and iron. Much time and energy is wasted, as



well as some considerable expense involved in taking small jobs to the blacksmith, because there is no suitable vice on the property. The accompanying illustration shows a handy implement which any farmer can construct for less than Six shillings. It will enable him to firmly hold bolts, nuts, or other iron work. Two pieces of hardwood 4 in. by 2 in. 2 feet long, are obtained; at one end of each a piece of iron plate, 3 in. by 3 in. by ¼ in., with two holes cut from the centre to

allow heads of bolts to pass; is countersunk. The fitting is shown in the illustration. The actual cost of making this is as follows:—

	s.	d.
One iron carpenter's bench screw	2	6
Four ft. hardwood, 4 in. by 2 in.	0	6
Two 3 in. by 3 in. by $\frac{1}{4}$ in. iron plates with screw holes countersunk in corners and centres punched out ... One 15-inch iron bar 1 in. by $\frac{1}{4}$ in. with $\frac{1}{4}$ in. holes for guide pin	2	6
Two bolts to fasten to bench	0	2
	5	8

CO-OPERATIVE OWNERSHIP OF BULLS.

By R. R. Kerr, Dairy Supervisor.

Of the many useful ways that co-operation could benefit the farmer, nothing would be more important than the principle applied to the buying and use of dairy sires. In all closer settlement dairying areas the herds are on the small side, numbering ten, twelve, or twenty odd cows. The keeping of a sire for so few a number of cows is not the best business arrangement, putting the farmer to unnecessary cost, both in the buying and keeping of the bull.

These small farms are generally handy one to the other. Can any strong argument be raised against one farmer caring for the bull, and the neighbours bringing their cows across for service? Surely the neighbourly spirit is existing to that extent. The system advocated would be for three or four farmers to combine or co-operate, and buy a good animal, and arrange between themselves as to whether one of the number should be paid for keeping the bull, or whether each should care for him in turn. The price of a good sire from a tested dam with a 400-lb. fat record, although a splendid investment, has one deterrent in that it is an outlay of cash that the small farmer can ill afford, because he has to wait three years to get the benefit of his investment. One bull judiciously used can serve at least fifty cows. If £30 or £40 were divided between three or four farmers the share of each would be £10—the price of the mongrel sire now so prominent. Were such a scheme adopted, its benefits would be manifold.

The resultant progeny would have a much higher market value, and the returns from the increased yields would many times pay for the original investment.

The improvement of herd yields is of national importance, considering the wealth of the dairying industry, and to the mind of the writer the selection of dairy sires is of equal importance to the industry as the certification of stallions to the horse breeders.

Bulls from dams yielding 400 lbs. fat are being slaughtered, simply because dairymen do not know their value, and refuse to give the few extra pounds asked for them. They are content to plod along using the mongrel sire, or nearly as bad, the pure sire from a worthless dam, raising useless stock—living monuments to such limited intelligence. The

pure bred sire will always demonstrate his right to be called the foundation of the dairy industry.

Too many who start in the business of breeding pure bred animals become discouraged, because they do not reap handsome profits during the first two or three years. It is often a long journey from beginning in the breeding of pure bred live stock to the position of a leader, whose produce is in demand at high prices. Ten years is but a short time, when it comes to establishing and making known a reputation as a real constructive, and honest breeder, no matter in what line one may be engaged. Twenty years or more is often required to attain the fullness of confidence and recognition on the part of buyers of pure stock. It takes years to build up the good-will that goes with profit-making in any business, where public confidence is an asset, and the breeding of live stock is no exception. If you feel that you have made a wise choice in the line of breeding you have selected, stay by your chosen breed. It will pay in the end. The in-and-out policy is neither constructive nor profitable.

SCIENCE AND THE DAIRY FARMER.

By E. W. Murphy, Dairy Supervisor.

The wonderful progress made by Denmark in a comparatively short time is a very striking instance of the value of science to the farm and of what can be done to alter the flow of population to the towns. With the development of the spirit of co-operation and of a very remarkable system of "Folk High Schools" and of "Local Agricultural Schools," as described by H. W. Foght, Specialist for the U.S.A. Bureau of Education, in his splendid book on these subjects published in 1915 there has been since 1890 a marked steady increase of production, and increase of rural population as against the exodus from rural districts to the cities, which had formerly been very pronounced in that country.

In Victoria there is ample scope for a tremendous increase in production and in rural population, and it will be mainly brought about through improvement of methods. To guard against losses due to starvation, as ordinarily understood, obviously requires conservation of foods to tide over droughty periods when fodder will be scarce, but various forms of malnutrition are due to special defects caused by bad management. The overcoming of such faults by the adoption of good farming practice is very closely associated with the awakening of a proper interest in rural life and so inducing the younger people to appreciate the wonders of nature and to realize that our setbacks are due to causes which can be removed if we will but apply that which is now known. A pressing need of the time is to bring about the practical application of that scientific knowledge concerning agriculture which is already known. Scientists are not all like Pasteur in their capacity to apply the lessons of the laboratory to actual every-day working conditions, and there is a need for a body of men who will be in constant touch with the work-a-day farming world, and, through the Department of Agriculture, have a connexion with the experimental stations and scientific research centres. As a link between the dairy farmer and the scientist we have a body of men known as supervisors. In selecting supervisors for the work the examiners give special consideration to their practical experience and ability, conjoined with a reasonable equipment of scientific knowledge, and evidence of their capacity and

readiness to learn more. The supervisor is not a mere inspector, though he may have to speak and act on some occasions as such, because there is a percentage of cases where negligence has become chronic and the sensibilities of the cow-keeper have become so blunted, that the ordinary stimulus has no effect, and his mind is closed to reason. In the minds of some of the country folk there is the idea which I recently heard expressed in the following remark:—"I don't want any model farm in this district, because those coves from the city, with their long-tailed coats, can't teach me how to farm." In such an objection there is evidence of a fear of impracticable advice, and useless expense being incurred, and the only hope for improvement of that type of mind is by actual demonstrations on neighbouring farms occupied by more open-minded settlers who are stimulated by the supervisor's visits

The work of these officers needs to be associated with the agricultural interests of the country State school, and it can be made a big factor in hastening the transition which we are undergoing from the pioneering stage; from the exploitation of the soil to more or less scientific systems of farming. To foster in the minds of the younger generations a sensible interest in rural matters generally is clearly the most important work of the country school with due regard to the special cases of extra capacity and desire of some scholars to follow city avocations or professons; but such has been, to some extent, obscured in the past by the ambition of the teachers to obtain the highest percentage of passes in examinations which gave very little room to rural interests.

The supervisor has not come from the classes who wear or who have worn long-tailed coats, and perhaps they are not likely to wear the insignia of science, the professor's robes, but they have graduated in the school of experience and are men of the world. There may be professors and scientists who are not sufficiently practical for the work-a-day world, but the supervisor, by his training, is fitted to suggest the next step in each case, and not to be or seem to be in the clouds. If the system should be extended so as to cover the whole State there would be a decided counter influence to the "drift to the cities," because every proper action of a supervisor comes directly under one or other of the headings in Roosevelt's formula for the prevention of such drift as described in the book by Sir H. Plunkett, *Rural Life Problems*, *i.e.*, better farming, better business, better living.

AN English paper points out that "the milk from cows that have been feeding on artichoke leaves is dangerous for infants. This peculiarity is said to explain cases of infant diarrhœa which occurred suddenly without apparent cause. It is a fact to be kept in view by dairymen and by doctors."—*Leader*, 24th March, 1917.

THE control of aphids, or plant lice, by means of ladybirds is proving a distinct success in America. During the years 1913 and 1914 a large number, estimated at about a million ladybirds, were distributed. The life of a ladybird from egg to egg is from four to six weeks—the life of a larva is about 20 days; an adult ladybird lives from 20 to 50 days. The number of aphids eaten by a larva during its lifetime is about 250; by an adult from 100 to 1,000. No further serious trouble from aphids has been reported from districts where ladybirds were well introduced.

SIXTH VICTORIAN EGG-LAYING COMPETITION, 1916-1917.

Commenced 15th April, 1916; concluded 14th April, 1917

CONDUCTED AT THE BURNLEY SCHOOL OF HORTICULTURE BY THE DEPARTMENT OF AGRICULTURE, VICTORIA.

CONCLUSION OF TEST.

Pen No. Six Birds.	Owner.	Breeds.	Previous Total.	Eleven days ended 14.4.17	Total to Date.
		LIGHT BREEDS.			
		WET MASH.			
1	G. McDonnell	White Leghorns ..	1,490	13	1,503
13	H. J. Meaddows ..	" ..	1,470	19	1,489
3	W. M. Bayles	" ..	1,450	12	1,462
41	Excelsior Poultry Farm ..	" ..	1,417	22	1,439
36	E. W. Hippe	" ..	1,419	11	1,430
28	S. Cheatle	R.C.B. Leghorns ..	1,402	20	1,422
10	H. J. Duncan	White Leghorns ..	1,384	15	1,399
8	E. A. Lawson	" ..	1,377	22	1,399
22	Mrs. H. Stevenson ..	" ..	1,384	13	1,397
37	J. M. Smith	" ..	1,375	7	1,382
40	A. Brundrett	" ..	1,353	28	1,381
32	N. Burston	" ..	1,353	25	1,378
38	V. Little	" ..	1,363	6	1,369
17	W. G. Swift	" ..	1,332	28	1,360
44	J. Jamieson	" ..	1,331	4	1,335
43	S. Bascumb	" ..	1,318	10	1,328
7	C. J. Jackson	" ..	1,310	15	1,327
11	R. W. Pope	" ..	1,294	27	1,321
25	A. H. Mould	" ..	1,275	16	1,291
12	G. Hayman	" (5 birds)	1,268	15	1,283
29	A. S. Hyndman ..	" ..	1,274	3	1,277
39	L. McLean	" ..	1,270	6	1,276
16	F. Collings	" ..	1,262	14	1,276
18	C. Ludwig	" ..	1,264	6	1,270
15	G. Laughlan	" ..	1,264	1	1,265
45	C. H. Oliver	" (5 birds)	1,248	10	1,256
6	J. J. West	" ..	1,242	3	1,245
14	W. R. Hustler	" ..	1,232	12	1,244
27	John Blacker	" ..	1,236	2	1,238
34	F. G. Silbereisen ..	" ..	1,221	7	1,228
23	T. A. Pettigrove ..	" ..	1,215	..	1,215
30	F. T. Denner	" (5 birds)	1,187	15	1,202
101	A. E. Silbereisen ..	" (5 birds)	1,193	8	1,201
24	H. N. H. Mirams ..	" ..	1,196	1	1,197
19	Bouwerren Egg Farm ..	" ..	1,187	9	1,196
5	W. G. Osburne	" ..	1,152	4	1,156
31	J. H. Gill	" ..	1,127	13	1,140
26	Mrs. A. Dumas	" (4 birds)	1,125	8	1,133
33	E. V. Evans	" ..	1,108	17	1,125
35	Tom Fisher	" ..	1,097	7	1,104
4	Fulham Park	" (5 birds)	1,072	4	1,076
9	W. H. Clingin	" ..	1,070	1	1,071
20	H. L. Merrick	" ..	1,062	8	1,070
		Total ..	54,667	485	55,152
		HEAVY BREEDS.			
		DRY MASH.			
100	Oaklands Poultry Farm ..	Black Orpingtons (5 birds)	1,360	20	1,380
98	Maryville Poultry Farm ..	" ..	1,292	9	1,301
97	D. Fisher	" ..	1,273	4	1,277
96	H. Hunt	" ..	1,058	14	1,072
94	Mrs. M. Coad	" ..	1,048	20	1,068
95	Mrs. T. W. Pearce ..	" ..	999	7	1,006
99	J. Ogden	" ..	790	..	790
		Total ..	7,820	74	7,894

SIXTH VICTORIAN EGG-LAYING COMPETITION, 1916-1917—*continued.*

Pen No. Six Birds.	Owner.	Breeds.	Previous Total.	Eleven days ended 14.4.17	Total to Date.
		LIGHT BREEDS.			
		DRY MASH.			
52	W. J. Thom	White Leghorns (5 birds)	1,517	14	1,531
53	W. N. O'Mullane ..	" ..	1,503	28	1,531
40	W. H. Robbins ..	" ..	1,472	29	1,501
54	Mrs. A. O. Hughes ..	" (5 birds)	1,413	11	1,424
63	N. Burston	" ..	1,391	24	1,415
69	E. A. Lawson	" ..	1,360	26	1,386
70	G. Wilkinson	" ..	1,354	7	1,361
59	T. A. Pettigrove ..	" ..	1,336	7	1,343
65	Izard and Tierney ..	" ..	1,312	14	1,326
55	Rev. J. Mayo	" ..	1,311	1	1,312
47	McKenzie and Son ..	" ..	1,299	9	1,308
60	A. Greenhalgh	" ..	1,254	6	1,260
58	C. Ludwig	" (5 birds)	1,233	9	1,242
62	J. W. Morrow	" ..	1,220	12	1,232
66	Benwerren Egg Farm ..	" ..	1,206	9	1,215
61	C. C. Dunn	" ..	1,198	11	1,209
67	Lysbeth Poultry Farm ..	" ..	1,194	..	1,194
48	Thirkell and Smith ..	" (5 birds)	1,187	15	1,202
56	Mrs. Nicoll	" ..	1,145	7	1,152
64	A. Bennett	" ..	1,133	7	1,140
50	Cleveland Poultry Farm ..	" ..	1,120	..	1,120
51	Reliable Poultry Farm ..	" (4 birds)	1,091	10	1,101
68	W. G. Osburne	" ..	1,038	5	1,043
49	G. Lane	" ..	1,028	4	1,032
		Total ..	30,305	262	30,567
		HEAVY BREEDS			
		WET MASH.			
74	Oaklands Poultry Farm ..	Black Orpingtons ..	1,387	22	1,409
80	Mrs. T. W. Pearce ..	" ..	1,261	21	1,282
86	C. Ludwig	" ..	1,276	4	1,280
91	N. Papanui	" ..	1,232	12	1,244
83	L. McLean	" (5 birds)	1,222	21	1,243
90	Excelsior Poultry Farm ..	" ..	1,229	6	1,235
87	S. Buscumb	" (4 birds)	1,218	14	1,232
92	J. H. Wright	" ..	1,172	8	1,180
89	Brooklyn Poultry Farm ..	" ..	1,157	19	1,176
93	L. W. Parker	" ..	1 161	..	1,161
77	Mrs. G. R. Bald ..	White Plymouth Rocks (5 birds)	1,135	11	1 146
84	H. L. Trevena	Rhode Island Reds	1,102	14	1 116
85	Mrs. M. Coad	Black Orpingtons ..	1,111	1	1 112
88	H. D. McLean	" (5 birds)	1,099	11	1 110
71	C. E. Graham	" ..	1,092	10	1,102
81	K. Courtenay	Faverolles ..	1 086	10	1 096
78	Reliable Poultry Farm ..	Black Orpingtons (5 birds)	1,044	22	1,066
82	J. Ogden	" ..	1,016	27	1,043
72	Marville Poultry Farm ..	" (5 birds)	1,003	9	1,012
76	L. A. Erroy	Silver Wyandottes	997	26	1,023
75	Mrs. Drake	Rhode Island Reds	937	14	951
73	E. W. Hippe	"	755	8	763
		Total ..	24,702	290	24,992

A. HART,
Chief Poultry Expert.

Department of Agriculture,
Melbourne, Victoria.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

CULTIVATION.

Cultivation work should be well on the way by this time. The ploughing should be advanced, so as to leave plenty of time for other orchard work. The autumn ploughing may be as rough as possible, taking care to plough to the trees, so that the drainage furrow is left between the rows.

MANURING.

It is just possible, where heavy crops have been carried, that a top dressing of stable manure will be required to add humus to the soil. The fertility of the soil must be maintained; and, although stable and chemical manures as a general rule are of undoubted value as tree stimulants, well-cultivated and thoroughly tilled land will always carry fair crops, and with far less manure than otherwise. Also, if the orchard land is well and thoroughly drained, cultivated, and sub-soiled, any manures that are used will be far more beneficial to the trees. The more suitable conditions that are given to the trees, the better they can appreciate and assimilate their food.

Perhaps the most useful and valuable of manures is stable manure. It is of great use, not only as a manure and as an introducer of necessary bacteria into the soil, but its value in adding humus to the soil is incalculable. Organic matter, such as stable manure, introduced into the soil quickly becomes humus; this greatly ameliorates and improves soil conditions. It is impossible to say what quantity of stable manure is necessary per acre; that alone can be determined by each circumstance. Orchards in different climates and in different soils will require differing quantities. A too liberal use of stable manure will be over-stimulating in most cases; while an excess beyond what is necessary for present use will only be waste, as humus is readily lost from the soil, once it is in an available food form.

It has been pointed out in these notes previously that an improved physical condition is far more profitable to the fruit-grower than the continued use of manures. A tree will be far more productive if it is happy in its soil conditions; uncomfortable conditions will always result in unprosperous trees.

A dressing of lime, using about 4 or 5 cwt. per acre, is of great value in stiff or heavy orchard lands; and it may be given at this season. The lime, which must be fresh, should be distributed in small heaps between the trees, covered with a layer of soil, and allowed to remain for a few days before ploughing or harrowing in.

PESTS.

The advice given last month for spraying should be followed, particularly where any oil emulsions or washes are to be used.

Orchards will benefit if an attack is now made upon the Codlin moth. All hiding places, nooks, and crannies, where the larvæ have hidden, should be thoroughly searched and cleaned out. The orchardist has far more time now to do this work than he will have in the spring time

GENERAL WORK.

Drainage systems should now be extended with as little loss of time as possible.

New planting areas should be prepared, and subsoiled or trenched wherever possible.

The Vegetable Garden.

Weeds must be kept down in the vegetable garden. Weeds are generally free growing at this season; their growth is very insidious, and they will crowd out the young seedlings or plants in a very quick time Hoeing and hand weeding must be resorted to, preferably hoeing. The frequent use of the hoe in winter time is of much benefit in the vegetable garden. A varied assortment of crops is now being produced; and if these can be kept growing much better crops will result. The soil quickly stagnates in the winter, and the only way to prevent this is to keep the surface stirred. Thus, a double service is performed with the aid of the hoe.

The application of lime is of great necessity at this season. In addition to amending unhealthy and unsuitable soil conditions, lime is particularly useful as an insecticide. It assists in destroying both eggs and insects in immense numbers, that would breed and live in the ground ready to do damage to all classes of vegetable crops. Therefore, wherever possible, the soil should receive an application of lime. The garden should, as well, be manured with stable manure, but not for some weeks after the lime application.

Cabbage and cauliflower plants may be planted out; and seeds of parsnips, carrots, onions, peas, and broad beans may be sown.

The Flower Garden.

The whole flower section should now be thoroughly dug over All beds should be cleaned up, top-dressed with manure, and well dug The light rubbish, such as foliage, twiggy growths, weeds, &c., may all be dug in, and they will thus form a useful addition to the soil. These should never be wasted. Only the coarser and stouter growths should be carted away for burning, and then the ashes may be used as manure No part, whatever, of garden rubbish or litter need be wasted. In one form or another it should be replaced in the soil.

May is a good month for establishing new gardens, and for planting out. All deciduous plants and shrubs may now be planted It is not

necessary to dig a deep hole for planting. A hole in which the roots of the plant can be comfortably arranged, without crowding or cramping, will be quite sufficient for the purpose.

Continue to sow seeds of hardy annuals, including sweet peas, although the main crop of sweet peas should be well above ground. Where there has been any overplanting, the young plants will readily stand transplanting, and this will greatly assist those that are to remain. Annuals should not be crowded in the beds. They require ample room for suitable development, and thus the seeds should be sown thinly or the plants set out a good distance from each other.

All herbaceous perennials that have finished blooming may now be cut down. Included amongst these are phlox, delphiniums, &c. If these are to remain in their present situation for another season it is always an advantage to raise them somewhat, by slightly lifting them with a fork, so that too much water will not settle around the crowns; they may also be mulched with stable manure, or the manure may be forked into the soil around the crowns.

REMINDERS FOR JUNE.

LIVE STOCK.

HORSES.—Those stabled and in regular work should be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half-an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley. Paddocked horses should be looked at from time to time to ascertain if they are doing satisfactorily.

CATTLE.—Cows, if not housed, should be rugged. Rugs should be removed and aired in the daytime when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of young grass. Cows about to calve, if over fat, should be put into a paddock in which the feed is not too abundant. If in low condition feed well to tide them over the period and stimulate milk flow. It should be borne in mind that the cows most liable to milk fever are those that have been low in condition and are rapidly thriving. The treatment described in the *Year-Book of Agriculture*, 1905, should be almost invariably successful. It will generally be found most profitable to have cows calve in autumn. They will then pay well for feeding through the winter, and will flush again with the spring grass. Calves should be provided with warm dry shed. Cows and heifers for early autumn calving may be put to the bull. Observe strict cleanliness and regularity with regard to temperature and quantity of feed to avoid losses and sickness incidental to calf rearing.

PIGS.—Supply plenty of bedding in well ventilated sties. Sows in fine weather should be given grass or lucerne run. Bulletin on the Pig Industry is now available.

SHEEP.—Clear muck-balls from tails and legs of all sheep. Have the wool cleared from round udders and eyes of all young lambing ewes, and see them first thing every morning. Mark the ram lambs at earliest chance. Cut off ewes with oldest wether lambs to best pasture or fodder crops.

Sheep with overgrown hoofs are unthrifty. Whenever noticed trim back into shape; they cut easily during winter. If left, are conducive to lameness, and even foot rot. In the case of common foot rot, or scald, the feet can be placed in a thick paste made of lime and boiling water. Obstinate cases of long standing may need more drastic remedies, and persistent attention. In all cases pare away all loose portions, and leave the diseased parts clearly exposed.

Foxes are more ravenous during winter months. Sparrows, starlings, and parrots are good bait. Poisoning lambs already killed usually accounts for scavenger foxes only, and in many cases innocent good dogs.

Every fox is not a lamb killer. Remove all lambs for two or three nights if at all possible, and birds then will rarely fail to entice Reynard the second or third night.

Powdered strychnine, just sufficient to cover nicely a threepenny-piece, is the usual dose. On the more valuable lambs fix a light tin collar, cut from 2 inches wide at the top of the neck to 3 inches wide below, fastened underneath in one place only, near the breast, with fine wire, and lying open towards the throat, allowing the lamb to both suck and feed. It should be cut as large as possible, yet not large enough to permit of its falling off over the lamb's head. This makes a guard that rarely fails to prevent a fox getting to the main blood vein. Remove the guards when the lambs are about eight weeks old.

POULTRY.—Supplies of shell grit and charcoal should always be available. Sow a mixture of English grass and clover; this not only removes taint in soil but provides excellent green fodder for stock. Where possible, lucerne and silver beet should now be sown for summer feed; liver (cooked) and maize aids to egg production during cold weather. Morning mash should be mixed with liver soup given to the birds warm in a crumbly condition. All yards should be drained to ensure comfort for the birds.

CULTIVATION.

FARM.—Plough potato land. Land to be sown later on with potatoes, mangolds, maize, and millet should be manured and well worked. Sow malting barley and finish sowing of cereals. Lift and store mangolds, turnips, &c. Clean out drains and water furrows. Clean up and stack manure in heaps protected from the weather.

ORCHARD.—Finish ploughing; plant young trees; spray with red oil or petroleum for scales, mites, aphis, &c.; carry out drainage system; clean out drains; commence pruning.

VEGETABLE GARDEN.—Prepare beds for crops; cultivate deeply; practise rotation in planting out; renovate asparagus beds; plant out all seedlings; sow radish, peas, broad beans, leeks, spinach, lettuce, carrot, &c.; plant rhubarb.

FLOWER GARDEN.—Continue digging and manuring; dig all weeds and leafy growths; plant out shrubs, roses, &c.; plant rose cuttings; prune deciduous trees and shrubs; sow sweet peas and plant out seedlings.

VINEYARD.—Thoroughly prepare for plantation, land already subsoiled for the purpose. Remember that the freer it is kept from weeds from this forward, the less trouble will there be from cut-worms next spring. Applications for grafted resistant rootlings (for delivery in 1918) must be made before the end of June next—see Journal for March, 1917. Pruning and ploughing should be actively proceeded with. In northern districts plough to a depth of seven or eight inches. Manures should be applied as early as possible.

Cellar.—Rack all wines which have not been already dealt with. Fortify sweet wines to full strength.

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REPORT ON THE EGG-LAYING COMPETITIONS FOR 1916-17, HELD AT BURNLEY SCHOOL OF PRIMARY AGRICULTURE AND HORTICULTURE.

Commenced 15th April, 1916. Concluded 14th April, 1917.

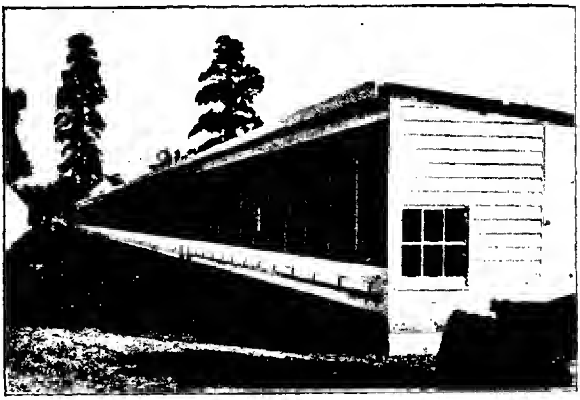
By A. Hart, Chief Poultry Expert.

The egg-laying competition which was concluded at Burnley in April last has been the medium of again establishing records, proving that the quality of the competing birds is still on the up grade, both individually and collectively. The conditions attending this last test were not at all favorable, for it was held during a fairly long and cold winter, succeeded by summer months of heavy rains and rough weather that practically amounted to a double winter, and checked the egg production to a great extent. However, notwithstanding these drawbacks the final figures were satisfactory. The poultry industry in Victoria is rapidly increasing and developing, and there is no doubt that a considerable portion of this extension is due to the excellent object lessons and comparisons provided by the competitions at Burnley. All poultry keepers hold a very high opinion of these tests, and the keen interest which is manifested in them by owners and the public throughout the year proves their worth. One of the reasons why the tests at Burnley are so popular is because they are held under Government supervision. All poultry keepers agree that the figures obtained at Burnley can be guaranted as absolutely correct in every respect, and when records are made, they are accepted without question. As a proof of the value of the laying competitions to the poultry industry generally, it may be mentioned that last year a pen of six winning White Leghorns was sold for £70, and two birds of the same variety which scored in single tests were purchased for £25 each. The full value of these birds without the competition "wins" to their credit would not exceed three guineas each. The figures quoted

5625.

are for genuine sales and, as the birds on each occasion were purchased by a breeder who does not keep fowls as a hobby, it may be safely assumed that the price paid was not above fair market value when the egg production of these birds was taken into consideration.

During the past ten years, I am pleased to say, a very great improvement has been effected in the egg production of White Leghorns and Black Orpingtons. In years past America led the way for prolific layers, but the figures which have been obtained by pens of six birds and by individual layers, as well as by the total number of birds at competitions in the Commonwealth, have exceeded the best records established in America, and Victoria can justly claim to have influenced these figures to a great extent. In the competitions just concluded at Burnley, White Leghorns and Black Orpingtons had by far the greatest representation, and they were also ahead in egg production. While allowing that these two breeds are the best egg-producing varieties, it



New Building at Burnley containing 150 single pens.

must also be admitted that if the same expert knowledge and careful breeding as have been given to White Leghorns and Black Orpingtons were given to other breeds, there is every reason to believe that they could be greatly improved.

The arrangement under which breeds other than those named competed has afforded valuable object lessons, and interesting comparisons are provided by the records of the egg production from the different breeds kept under exactly similar conditions. The provision of single testing pens has brought the present competitions at Burnley up to date, and all breeders are unanimous in declaring for single testing as the only reliable method of indicating the best layers. As a proof of the high opinion in which single testing is held by competitors, it may be stated that they unanimously agreed to forgo all prize money for the tests of the current year on condition that the Department would provide single pens for the testing of the different breeds, and the erection of 150 single pens was completed early in April.

They were constructed on the most approved lines, and it is gratifying to find that poultry owners and experts are unanimous in their opinions as to the suitability of these pens for the purposes required. Everything conducive to egg production and keeping the birds in good health and condition has been provided, and it is confidently expected that the results will fully justify the outlay from a financial point of view, besides furnishing the means of obtaining a reliable indication of the laying powers of every individual bird in the single test. This new arrangement will also allow the birds to be fed and cared for with very little trouble to the attendant.

The recent report of the poultry and egg industry in England provides some very interesting information. It is estimated that in normal times the value of eggs and poultry imported into England runs into £10,500,000 a year. But owing to war conditions the importations have fallen off to a very great extent, and for the year 1916 the eggs sent to England amounted to 66,064,110 dozen, valued at £4,741,401, as against 217 599 500 dozen, valued at £9,590,602, in 1913. When to the latter figures is added the value of the very large quantities of eggs and poultry produced in England, an idea of the enormous consumption of both products can be estimated. In normal times the English importations were received from several countries on the Continent, as well as from Canada and the United States. Denmark and Russia were the largest contributors. In 1913 Russia exported to England eggs valued at £4,000,000, but in 1916 this was reduced to £423,949. Denmark in 1913 sent eggs valued at £2,296.843, but in 1916 these figures fell to £1,303,177. These statistics provide convincing proof that there is an enormous demand for eggs and poultry in England. Should the Commonwealth enter into competition with the other nations in providing portion of England's yearly requirements, there is no danger of her supplies overloading the market. An almost unlimited quantity both of eggs and poultry could at present be placed on the English markets at prices which must be regarded as abnormally high. Guaranteed fresh eggs are now worth about 4d. each in England, and the prices of poultry are correspondingly high. There is ample room for the extension of the poultry industry in Victoria as well as in the other States of the Commonwealth, and there is no reason why in the near future a regular and profitable trade in the exportation of eggs to England should not be established. We have undoubtedly the very best climatic conditions for poultry breeding in the world. Our area of land suitable for the production of wheat (the staple food for poultry) is practically unlimited, and if we can send the products of the land in the concentrated form of eggs and poultry, it should return a much greater revenue to the country than if wheat, oats, or other grains are sent to England in bulk form.

When choosing birds for the competitions, mistakes are sometimes made by the owners, and I would especially impress upon them the necessity for making a very careful selection. Men experienced in the contests have already learned this lesson, and in these days of keen rivalry every detail must be carefully observed if owners wish their birds to be in the first flight. The selection of competing birds ought not to be made in a haphazard manner from a competitor's whole flock. About 20 of the best pullets from one mating, and as uniform in age and size as possible, should be selected and placed in a run by themselves for at

least three weeks before a final selection is made. During this time they must be carefully observed and the best seven or eight chosen. Until they are sent away, they should be given food exactly similar to that they will be fed upon at Burnley (particulars of which will be found in this report). Of course, where single pullets are entered for competition it may be advisable to include different varieties from which to make a final selection, but in the pens of six the birds should be of one strain, so that in the event of their reaching a high position in the test they may be used later on as stud stock with the strain guaranteed.

In the recent yearly test at Burnley 576 birds competed. This number was reduced by 21 owing to some of the pullets being under weight and by the death of a few in the course of the competition. It is

Interior of new Fowl House at Burnley.

gratifying to find that, although the weather conditions were somewhat adverse, only one case of disease was noted, and that was a mild form of chicken-pox. The deaths which took place were all due to ovary troubles. The tests for birds fed on wet and dry mash respectively provided interesting comparisons. In comparing the results of the two systems the slight difference that was noticed in egg production was in favour of the wet mash. But the dry mash certainly entails much less trouble in feeding, and allows persons who are engaged in other pursuits to provide a regular supply of food for their stock. The results show that it is quite possible to secure good results from both methods. The total number of eggs produced by the 576 birds for the twelve months was 118,610, which gives an average of 205¾ eggs per bird. As no replacements were allowed for the birds that were found to be ineligible for the competition or for those that died, the total average may be regarded as satisfactory in every respect. All things considered, the

winter test was better than usual. The heavy breeds test included the winner of the winter months' prize. A pen of six Black Orpingtons from the Oaklands Farm produced 570 eggs for the four months, constituting a world's record, and Mr. W. H. Robbins' White Leghorns produced 545 eggs for the same period, winning in the Light Breeds test for the winter months. It is very gratifying to report that every pen of birds in the competition produced eggs which were up to or above the standard weight required at the time of weighing.

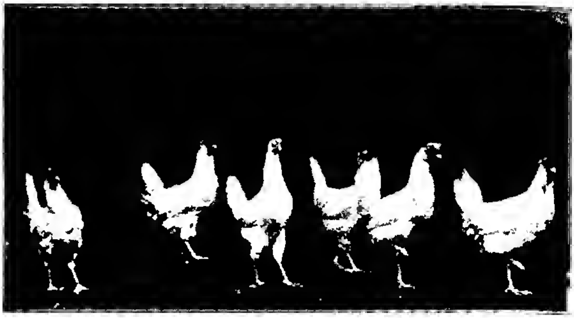
The winning pen in the Light Breeds, Wet Mash Test, was Mr. G. McDonnell's six white leghorns, which produced 1,503 eggs in the year. The birds were of fair size and a good laying type, and the forward position which they held during the greater portion of the twelve months classes them as uniform and consistent egg-producers. In the Light Breeds, Dry Mash Test, the competition was very keen between the two leading pens. Mr. W. J. Thom's pen was handicapped by the loss of

First Prize Winners in Heavy Breed (Dry Mash) Section—Owned by the Oaklands Poultry Farm.

one bird, which died several weeks before the test ended, and although it had at this time a good lead from Mr. W. N. O'Mullane's pen, which was second on the list, the latter gradually bettered its position, and the final result was a tie for the first place between the two pens, each of them producing 1,531 eggs. The leading place for heavy breeds, wet mash, was gained by six Black Orpingtons from the Oaklands Poultry Farm. They produced 1,409 eggs for the twelve months. The birds were fair representatives of the breed, as well as being first-class egg-producing types. Six birds of equal quality from the same farm secured first place with 1,380 eggs in the dry mash test, after having lost a bird near the close of the test, the Marville Poultry Farm's six Black Orpingtons being second with 1,301 eggs.

Taking into consideration the quality and general appearance of the White Leghorns in the competition they show a decided improvement on those of former years, and although a few birds were somewhat undersized, they made up a very good average collection. The Black

Orpingtons were also much better in type than previously. The insertion of the rule regarding the weight of the birds was, to a great extent, responsible for the improvement, and the final results should work out in the production of stock, which will not only be prolific egg-producers, but will also hold a high position as table and general purpose birds. White Plymouth Rocks, Silver Wyandottes, Faverolles, and Rhode Island Reds competed with Black Orpingtons in the heavy breed test (wet mash). Excluding the Black Orpingtons, a pen of White Rocks

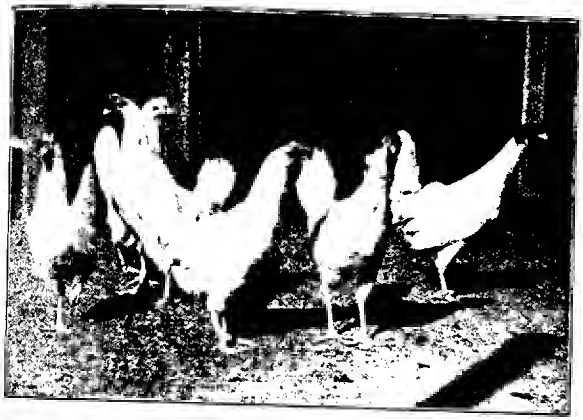


First Prize Winners in Light Breed (Wet Mash) Section—Owned by Mr. G. McDonnell.

Mr. W. J. Thom's Pen of White Leghorns tied for first place in Light Breed (Dry Mash) Section.

showed the best return, producing 1,146 eggs in the twelve months. A pen of Rhode Island Reds produced 1,116 eggs, but the average from this breed was reduced by two other pens which only contributed 951 and 763 eggs respectively. A pen of Faverolles contributed 1,096 eggs.

which, considering the table properties of this breed, is a good performance. A pen of Silver Wyandottes was rather low on the list with 1,023 eggs. The inclusion in the tests now in progress of a class for heavy breeds other than Orpingtons should encourage breeders to improve the egg production of these varieties by careful mating and selection. There is no doubt that there is a great opportunity for advancing the popularity of these breeds by increasing their egg-producing qualities, and it appears quite reasonable to expect that, if breeders would exercise the same expert knowledge and care in selection, breeding, and mating as has been given to Black Orpingtons, the result would be satisfactory from every point of view. I would remind readers that eggs at the present time are the main source of revenue from poultry in Victoria, and if an increased egg production can be obtained from any breed, it must improve the value of that variety for general purposes.



Mr. W. N. O'Mullane's Pen of White Leghorns tied for first place in Light Breed (Dry Mash) Section.

The system of feeding adopted during last year differed slightly from previous years. The wet mash was composed of (by measure) 6 parts bran, 4 parts wheat pollard, 2 parts ground oats, 3 parts oaten pollard, and 1 part pea meal. With this $\frac{3}{4}$ oz. of salt was added for every 100 birds, and $\frac{1}{2}$ lb. brown sugar was mixed with the mash twice a week. The whole was well mixed together and formed into a crumbly mash by the addition of liver and meat soup. This was fed to the birds for the morning meal, and the liver and meat were chopped up fine and given twice a week in the mash. Chaffed green stuff was given at noon. Sufficient green food was produced and fed, which obviated the necessity of using a substitute in lucerne chaff or meal (dry). The evening meal was composed of 3 parts wheat, 1 part oats, and $\frac{1}{2}$ part maize slightly varied according to weather conditions. The dry mash was composed of (by measure) $1\frac{1}{2}$ parts bran, $\frac{1}{2}$ part ground oats, 1 part wheat pollard, $\frac{1}{2}$ part oaten pollard, and $\frac{1}{2}$ part pea meal. About 1 per cent. of brown

sugar was mixed with the mash, which was fed with automatic feed-hoppers. At noon minced liver and meat was fed daily at the rate of 2 to 3 ozs. for each six birds, a very small portion of salt being added.

The total amount received for the eggs during the test was £620 13s. 2d., and the cost of food amounted to a fraction under 2d. per bird per week—the average return from each bird thus works out at 21s. 6d. each (gross), and the net profit over cost of food at 12s. 9d. per bird. It should perhaps be pointed out that the price of all grain and poultry feed was excessive during the period of the competition.

The care of the birds was in the expert hands of Mr. J. T. Macaulay, and there is no doubt that a considerable portion of the success attained was due to his regular attention and close observance during the whole of the competition. The excellent health and good condition of the birds right through the year is ample evidence of the manner in which Mr. Macaulay performed his arduous duties. A word of praise is also due to Mrs. Macaulay, who gave valuable assistance by keeping a correct record of all eggs produced, and in many other matters of detail in connexion with the tests.

In concluding this report I would again bring under notice the great possibilities of the poultry industry in Victoria. The Department has done much towards fostering and improving poultry keeping and breeding, and, with a continuation of the good work which has been done in the past, the industry will extend and develop, and when normal conditions are again with us, it should bring in a very large annual revenue to the State.

Owner.	Breed.	Total number of eggs laid.	Average number per bird.	Market value at 1s. 3d. per doz. £ s. d.
LIGHT BREEDS.—WET MASH.				
1. G. McDonnell ..	White Leghorns ..	1,503	250½	7 16 6¾
2. H. J. Meaddows ..	,, ,, ..	1,489	248⅙	7 15 1¼
3. W. M. Bayles ..	,, ,, ..	1,462	243⅔	7 12 3½
LIGHT BREEDS.—DRY MASH.				
1. { W. J. Thom* ..	White Leghorns ..	1,531†	255⅙	7 19 5¾
{ W. N. O'Mullane* ..	,, ,, ..	1,531	255⅙	7 19 5¾
2. W. A. Robbins ..	,, ,, ..	1,501	250⅙	7 16 4¼
3. Mrs. A. O. Hughes ..	,, ,, ..	1,424	237⅓	7 8 4
HEAVY BREEDS.—WET MASH.				
1. Oaklands Poultry Farm	Black Orpingtons ..	1,409	234⅚	7 6 9¼
2. Mrs. T. W. Pearce ..	,, ,, ..	1,282	213⅔	6 13 6½
3. C. Ludwig	,, ,, ..	1,280	213⅓	6 13 4
HEAVY BREEDS.—DRY MASH.				
1. Oaklands Poultry Farm	Black Orpingtons ..	1,380‡	230	7 3 9
2. Marville Poultry Farm	,, ,, ..	1,301	216⅚	6 15 6¼
3. D. Fisher	,, ,, ..	1,277	212⅚	6 13 0¼

* Tied for first place.
† One of the birds of this pen died before the competition was concluded.
‡ One of the birds of this pen died a few weeks before conclusion of test.

LIGHT BREEDS.

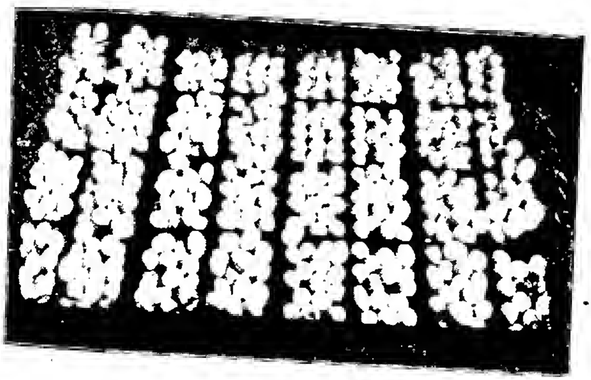
Wet Mash.

First Prize won by G. McDONNELL, with six White Leghorns that laid **1,503 eggs in one year,** which, at 1s. 3d. per dozen, would return £7 16s. $6\frac{3}{4}$d.

LIGHT BREEDS.

Dry Mash.

First Prize divided between W. J. THOM and W. N. O'MULLANE, whose pens of six White Leghorns each produced **1,531 eggs in one year.** 1,531 eggs at 1s. 3d. per dozen would return £7 19s. $5\frac{3}{4}$d



HEAVY BREEDS.

Wet Mash.

First Prize won by OAKLANDS POULTRY FARM, with six Black Orpingtons that laid **1,409 eggs in one year,** which, at 1s. 3d. per dozen, would return £7 6s. $\frac{3}{4}$d.

HEAVY BREEDS.

Dry Mash.

First Prize won by OAKLANDS POULTRY FARM, with six Black Orpingtons that laid **1,380 eggs in one year,** which, at 1s. 3d. per dozen, would return £7 3s. 9d.

CONCLUSION OF TEST.

LIGHT BREEDS—WET MASH.

Owner.	Breed.	15.4.16 to 14.5.16.	15.5.16 to 14.6.16.	15.6.16 to 14.7.16.	15.7.16 to 14.8.16.	15.8.16 to 14.9.16.	15.9.16 to 14.10.16.	15.10.16 to 14.11.16.	15.11.16 to 14.12.16.	15.12.16 to 14.1.17.	15.1.17 to 14.2.17.	15.2.17 to 14.3.17.	15.3.17 to 14.4.17.	Total.	Position in Competition.
. McDonnell	White Leghorns	111	118	115	129	147	152	144	139	136	131	104	77	1,503	1
. J. Meaddows	"	122	118	107	119	138	147	119	138	144	123	169	75	1,489	2
. M. Bayles	"	110	103	58	122	144	150	158	159	151	135	107	65	1,462	3
xcelsior Poultry Farm	"	108	120	90	117	132	138	146	138	139	126	89	87	1,439	4
. W. Hippe	"	113	127	103	108	135	141	152	146	140	109	81	72	1,430	5
. Cheatle	R.C. Brown Leghorns	83	123	110	105	129	134	148	142	138	133	94	77	1,422	6
. H. Duncan	White Leghorns	44	143	130	140	150	153	150	120	102	108	87	72	1,399	7
. A. Lawson	"	52	66	88	105	139	151	162	152	134	138	113	99	1,399	
rs. H. Stevenson	"	83	115	119	123	131	132	147	132	134	125	96	57	1,397	9
. M. Smith	"	103	116	111	90	137	150	151	143	132	115	79	55	1,382	10
. Brundrett	"	115	132	106	98	139	126	147	117	133	114	85	69	1,381	11
. Burston	"	41	124	86	123	122	149	144	139	131	129	96	91	1,378	12
. Little	"	115	117	90	110	132	146	138	123	127	111	99	61	1,369	13
W. G. Swift	"	120	135	83	82	132	133	138	126	117	119	87	88	1,360	14
. Jamieson	"	71	133	101	98	137	145	143	144	136	97	80	50	1,335	15
. Buscumb	"	70	50	86	92	149	150	160	137	135	130	101	68	1,328	16
. J. Jackson	"	108	137	122	114	119	128	139	123	113	92	77	53	1,325	17
R. W. Pope	"	121	112	29	66	114	149	146	130	130	117	87	90	1,321	18
A. H. Mould	"	104	133	119	112	127	145	116	106	101	94	71	63	1,291	19
G. Hayman	"	109	87	51	80	139	146	145	129	115	109	89	72	1,283	20
A. S. Hyndman	"	50	93	93	96	133	149	156	145	136	120	67	30	1,277	21
L. McLean	"	12	124	112	113	138	137	147	139	117	133	62	42	1,276	22
F. Collings	"	115	115	56	70	128	133	134	131	130	122	82	60	1,276	
C. Ludwig	"	103	80	90	103	126	128	137	134	126	115	81	47	1,270	24
G. Laughlan	"	113	91	85	122	131	142	141	130	126	97	56	28	1,265	25
C. H. Oliver	"	83	93	96	127	131	131	131	115	115	98	80	56	1,256	26
J. J. West	"	101	57	78	119	131	133	132	133	113	111	100	37	1,245	27
W. B. Hustler	"	65	113	107	107	131	133	133	124	114	100	64	53	1,244	28
John Blacker	"	116	134	93	103	128	105	124	111	104	94	90	36	1,238	29
F. G. Silbereisen	"	105	105	75	99	118	130	127	125	117	106	71	50	1,228	30
T. A. Pettigrove	"	93	109	95	111	122	124	137	119	105	112	60	28	1,215	31
F. T. Denner	"	79	125	79	112	119	122	116	109	110	92	77	62	1,202	32
A. E. Silbereisen	"	15	91	108	115	123	143	124	115	126	107	82	52	1,201	33
H. N. H. Mirams	"	79	126	118	120	118	105	114	112	105	103	69	28	1,197	34
Benwerren Egg Farm	"	65	79	61	97	128	132	138	135	117	113	77	54	1,196	35
W. [illegible] Osborne	"	101	61	43	84	119	118	140	131	129	111	73	46	1,156	36
J. H. Gill	"	32	25	24	53	127	116	151	144	129	130	109	69	1,140	37
Mrs. A. Dunn	"	104	101	69	81	121	126	136	98	98	88	95	46	1,133	38
E. F. Evans	"	51	87	59	80	118	136	131	127	109	119	84	71	1,125	39
Tom Fisher	"	[illegible]	64	108	65	121	130	152	127	128	98	65	[illegible]	[illegible]	40
Fulham Park	"	[illegible]	31	51	[illegible]	121	149	149	141	129	109	73	36	1,078	41
W. H. [illegible]	"	[illegible]	12	[illegible]	[illegible]	[illegible]	129	129	130	116	85	81	48	1,071	42
W. [illegible]	"	[illegible]	66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120	127	92	60	30	1,070	43

LIGHT BREEDS—DRY MASH.

Owner.	Breed.	15.4.16 to 14.5.16.	15.5.16 to 14.6.16.	15.6.16 to 14.7.16.	15.7.16 to 14.8.16.	15.8.16 to 14.9.16.	15.9.16 to 14.10.16.	15.10.16 to 14.11.16.	15.11.16 to 14.12.16.	15.12.16 to 14.1.17.	15.1.17 to 14.2.17.	15.2.17 to 14.3.17.	15.3.17 to 14.4.17.	Total.	Position in Competition.
W. J. Thom	White Leghorns	126	127	99	139	160	161	165	154	153	108	80	57	1,531	
W. N. O'Mullane	..	115	129	105	123	146	154	159	147	140	127	102	86	1,531	
W. H. Robbins	..	140	134	156	135	157	138	147	125	121	97	78	93	1,501	
Mrs. A. O. Hughes	..	108	141	100	79	138	152	151	136	131	127	79	62	1.424	
N. Burston	..	..	56	103	137	156	158	159	158	157	135	110	86	1.415	
E. A. Lawson	..	91	61	88	124	141	152	152	138	131	122	92	94	1,386	
G. Wilkinson	..	113	112	110	150	137	141	143	133	120	109	73	40	1,361	
T. A. Pettigrove	..	134	139	142	131	139	135	124	118	104	93	53	41	1,343	
Izard and Tierney	..	110	122	93	97	139	142	156	109	112	107	81	69	1,326	
Rev. J. Mayo	..	119	62	65	111	145	150	157	144	135	112	82	30	1,312	
McKenzie and Son	..	83	93	115	126	158	151	130	136	115	102	56	33	1,308	
A. Greenhalgh	..	77	98	90	94	131	134	149	140	121	116	72	38	1,260	
C. Ludwig	..	105	137	101	105	145	151	110	91	87	98	67	45	1.242	
J. W. Morrow	..	104	126	91	100	134	132	131	122	79	99	72	43	1,232	
Benwerren Egg Farm	..	15	49	76	115	146	154	157	142	113	124	84	40	1.215	
C. C. Dunn	..	128	130	105	91	119	123	105	110	86	103	65	44	1.209	
Lysbeth Poultry Farm	..	60	87	86	106	136	146	150	143	130	117	29	4	1.194	
Thirkell and Smith	..	95	97	75	107	134	135	134	121	106	88	61	49	1.202	
Mrs. Nicoll	..	104	136	127	126	123	121	110	97	92	62	34	20	1,152	
A. Bennett	..	110	83	40	17	109	140	140	131	116	114	92	48	1,140	
Cleveland Poultry Farm	..	57	69	53	97	133	140	144	118	123	90	61	35	1.120	
Reliable Poultry Farm	..	80	60	64	80	128	137	142	125	108	84	56	37	1,101	
W. G. Osborne	..	20	43	30	79	159	141	131	122	110	95	72	52	1,043	
G. Lane	..	84	85	99	65	126	109	127	80	113	79	52	16	1.032	
		2,185	2,376	2,181	2,524	3,319	3,397	3,353	3,040	832	2,508	1,703	1 162	30 580	

CONCLUSION OF TEST.

HEAVY BREEDS—WET MASH.

Owner.	Breed.	15.4.16 to 14.5.16.	15.5.16 to 14.6.16.	15.6.16 to 14.7.16.	15.7.16 to 14.8.16.	15.8.16 to 14.9.16.	15.9.16 to 14.10.16.	15.10.16 to 14.11.16.	15.11.16 to 14.12.16.	15.12.16 to 14.1.17.	15.1.17 to 14.2.17.	15.2.17 to 14.3.17.	15.3.17 to 14.4.17.	Total.	Position in Competition.
Oaklands Poultry Farm	Black Orpingtons ..	140	154	120	156	150	139	122	96	112	83	72	65	1,409	1
Mrs. T. W. Pearce	" " ..	101	109	102	132	150	108	122	102	114	96	75	68	1,282	2
C. Ludwig	" " ..	118	117	80	135	147	110	131	136	99	93	63	42	1,280	3
N. Papayanni	" " ..	36	70	100	147	153	143	125	108	115	108	80	50	1,244	4
L. McLean	" " ..	69	128	130	120	115	92	96	112	97	95	81	72	1,243	5
Excelsior Poultry Farm	" " ..	40	92	114	125	157	153	134	128	107	91	64	30	1,235	6
S. Buscumb	" " ..	119	119	115	124	148	124	114	107	83	90	43	46	1,232	7
J. H. Wright	" " ..	60	135	129	152	134	110	128	85	61	75	54	57	1,180	8
Brooklyn Poultry Farm	" " ..	136	150	110	126	126	113	105	75	77	44	60	54	1,176	9
L. W. Parker	" " ..	49	146	108	118	127	101	114	100	95	98	82	14	1,161	10
Mrs. G. R. Bald	White Plymouth Rocks	56	91	70	123	127	122	123	128	68	98	77	63	1,146	11
H. L. Trevena	Rhode Island Reds ..	30	49	98	111	126	121	128	103	114	89	89	58	1,116	12
Mrs. M. Cuad	Black Orpingtons ..	91	109	128	138	143	124	105	103	63	62	23	23	1,112	13
A. D. McLean	" " ..	60	138	115	135	131	123	96	87	58	74	61	32	1,110	15
C. E. Graham	" " ..	..	40	95	132	130	135	131	102	106	102	76	53	1,102	15
K. Courtenay	Faverolles	87	98	86	71	101	122	137	103	101	87	71	32	1,096	16
Reliable Poultry Farm	Black Orpingtons ..	33	98	111	113	145	134	87	86	65	72	54	65	1,066	17
J. Ogden	" " ..	3	1	67	130	139	129	112	88	118	105	63	88	1,043	18
L. A. Errey	Silver Wyandottes ..	18	33	83	139	119	119	98	88	82	92	86	66	1,023	19
Marville Poultry Farm	Black Orpingtons ..	141	119	74	107	115	95	90	61	75	61	39	35	1,012	20
Mrs. Drake	Rhode Island Reds ..	32	18	58	94	122	103	118	88	113	86	63	61	951	21
E. W. Hippe	" " ..	10	64	85	112	110	102	68	48	39	30	32	33	763	22
		1,162	2,078	2,181	2,746	2,945	2,631	2,479	2,143	1,962	1,831	1,408	1,116	24,982	

HEAVY BREEDS—DRY MASH

Owner.	Breed.	15.4.16 to 14.5.16.	15.5.16 to 14.6.16.	15.6.16 to 14.7.16.	15.7.16 to 14.8.16.	15.8.16 to 14.9.16.	15.9.16 to 14.10.16.	15.10.16 to 14.11.16.	15.11.16 to 14.12.16.	15.12.16 to 14.1.17.	15.1.17 to 14.2.17.	15.2.17 to 14.3.17.	15.3.17 to 14.4.17.	Total.	Position in Competition.
Oaklands Poultry Farm	Black Orpingtons ..	68	132	121	143	147	123	126	120	126	112	91	71	1,380	1
Marville Poultry Farm	" " ..	78	157	135	139	161	125	121	101	97	95	53	39	1,301	2
D. Fisher	" " ..	95	128	119	143	136	115	130	93	109	82	76	51	1,277	3
H. Hunt	" " ..	..	18	119	143	138	124	136	117	103	81	45	48	1,072	4
Mrs. M. [illegible]	" " ..	30	130	113	111	131	104	107	87	103	67	22	63	1,068	5
Mrs. T. W. Pearce	" " ..	70	61	101	111	138	135	101	89	72	55	46	24	1,006	6
J. Ogden	" " ..	3	39	18	91	132	84	103	77	94	64	44	11	790	7
		[illegible]	665	756	884	984	810	821	684	704	[illegible]	[illegible]	[illegible]	[illegible]	

APPLE CULTURE IN VICTORIA.

By J. Farrell, Orchard Supervisor.

(Continued from page 294.)

Nature's Method of Building the Tree.

When the apple tree is allowed to commence life through being enabled to germinate from the pip or seed, or when propagated from a root-graft or layer it is developed by the annual multiplication and extensions of its roots and branches. While these developments are taking place the wood of the root system, the stem, and that of the tree's superstructure becomes thickened by the addition of corresponding rings of new wood which are formed during the successive periods of vegetation.

The clusters of leaf scars on the bark of the branches of unpruned trees between the wood growth of the various ages denote the positions of the original terminal buds, while the marks on the leaders of annually-pruned trees, as well as the concentric circles which circumscribe the wood rings, and which may be observed in transverse sections of the stem and branches, likewise indicate the periods of rest.

Following each dormant period which is caused mostly by the prevalence of low temperatures during the lull of winter comes the regular, familiar, but nevertheless remarkable, phenomenon of the bare branches of the tree gradually bursting apart the scales of their leaf buds, and revealing the delicate forms of the rudimentary leaves which soon expand into a rich garment of green foliage.

This wondrous change is brought about by the genial return of spring and the accompanying rise of temperature which acts upon the invigorating materials stored up in the tree causing them to vigorously renew their activities.

The warmer conditions also sweeten the soil, and, to some extent, prepare the plant food which the feeding roots of the tree absorb in the form of crude sap, made up of mineral nitrates in solution.

How the raw sap is absorbed by the points of the feeding roots, the manner in which it travels to the leaves in which it is assimilated and converted into elaborated sap, and subsequently distributed to the various parts of the tree and to the fruit, are problems which have long puzzled physicists. The old theory that capillary attraction is the agency by which the raw sap is carried up the trunk and branches of the tree like oil through the wick of a lamp seemed a totally inadequate explanation. The general consensus of opinion among modern physicists, however, is, as they explain, that the sap in the tree moves in the various directions simultaneously by a process which they term osmosis.

The high, but practically incalculable pressure, exerted in some of the internal tissues of the stem, and also distributed more or less irregularly through the tissues of other parts of the tree, forces the cap to the growing points of the leaders, laterals, and to the other buds. This causes the leaves to expand, and the process continues while the building up of new structures is going on during the currency of the period of vegetation.

It is obvious, therefore, that Nature's engineering arrangements, by which, during the periods of growth, the continuous stream of life-giving sap is carried through, and controlled in the various sap channels of the tree, are so perfectly organized, that they are marvels of her mechanical ingenuity.

The different parts of the tree are made up of countless millions of small cells constructed in various shapes according to the positions which they occupy in the tree edifice.

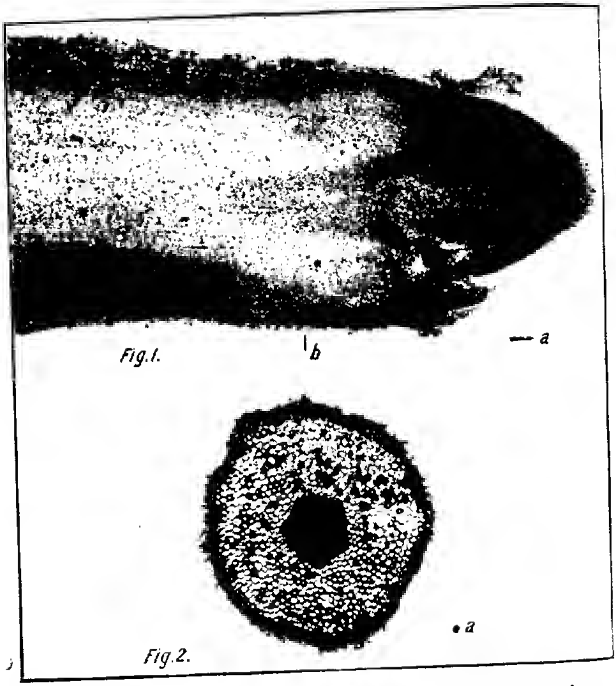


Plate 91.—Fig. 1, section of Feeding Root highly enlarged.

Natural size and magnification marked a and b on Fig. 1 and a on Fig. 2

Owing to the keenness of competition and friendly rivalry which exists among the various fruit-growing States it behoves every person entering into fruit production to become possessed of at least a fairly good, elementary knowledge of the structural formation of his trees, and the functions of their various organs. This necessity is becoming daily more apparent on account of the advancement of horticultural science supported by industrial effort, and fostered by the Commonwealth and by the various State Governments.

The orchardist with an intimate knowledge of his trees' structural formation, and particularly in relation to their feeding roots, has a special advantage over the one lacking such information.

The Northern Spy variety, on account of the freedom with which it produces roots from the leaf buds on the scion of the root-graft, the

Plate 92.—**Point of Feeding Root shown in Plate 91 (Fig. 1), but more highly enlarged.**

regular and extensive branching habit of the root system together with its immunity from Woolly Aphis, is now almost exclusively used as stocks for the others in cultivation.

Although most of the cultivated varieties apparently maintain their respective characteristics in relation to their growth, blossoming, and fruiting habits, &c., yet it is probable that in ...

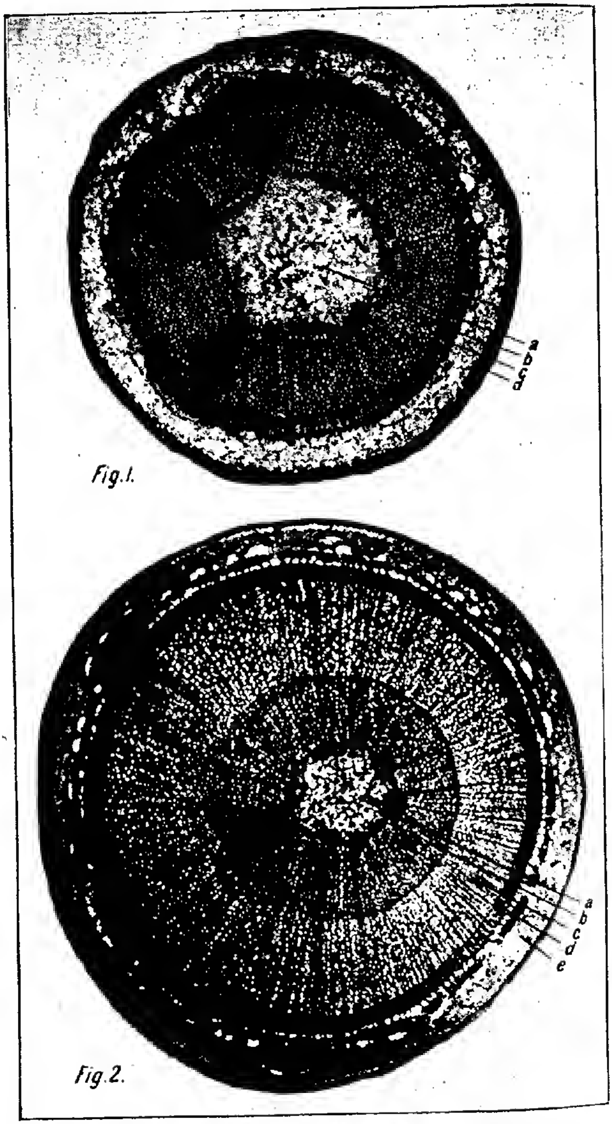


Plate 93.—Fig. 1: Cross section of yearling wood of Jonathan.
Fig. 2: Cross section of two-year-old wood of Jonathan.

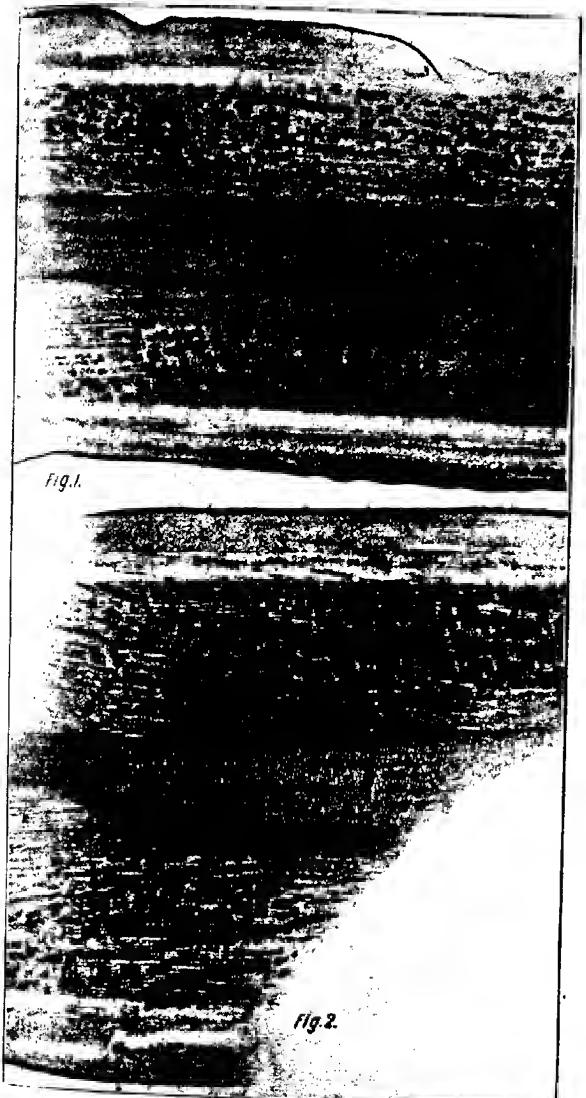


Plate 94.—Fig. 1: Longitudinal section of one-year-old Jonathan wood.
Fig. 2: Longitudinal section of two-year-old Jonathan wood.

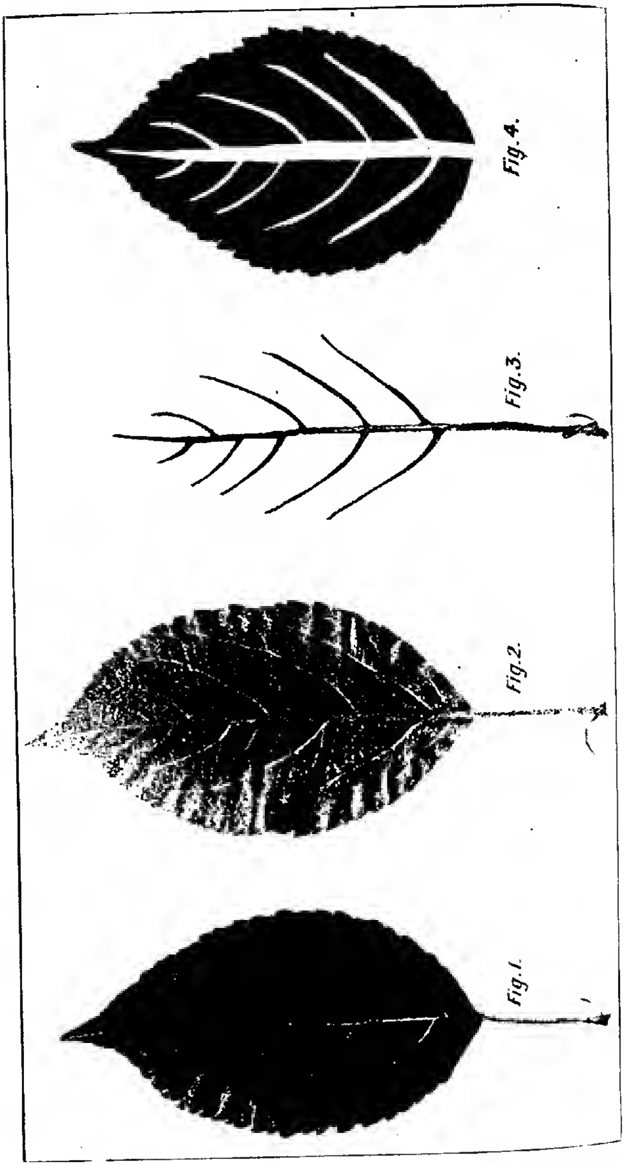


Plate 95. Leaves of Jonathan Apple Tree.

they, or at least some of them, particularly when grown under those soil and climatic conditions, which are apparently favorable to the development of this disease, are influenced by the stocks on which they are worked.

This is a matter which requires much observation and experiment, and one in which the orchardist should play a prominent part. But in order to do this satisfactorily a good knowledge regarding the structural botany of the apple tree is essential.

Then by understanding the functions of the various organs of the tree, and with a knowledge of osmosis, the fruit-grower will find himself equipped with information which will be of considerable assistance to him in connexion with his study of the growth of the tree, particularly in relation to soil cultivation, manuring, drainage, irrigation, pruning, &c.

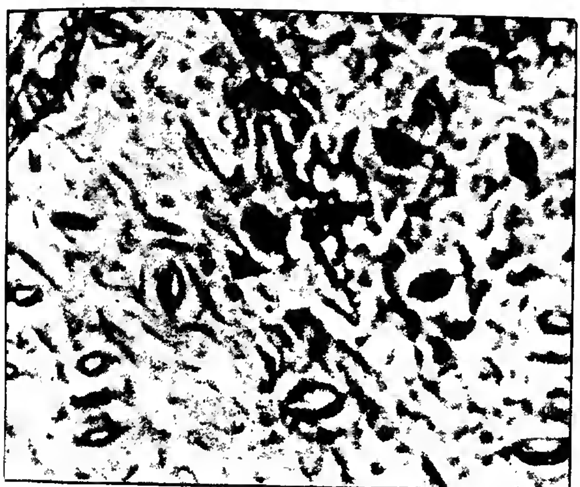


Plate 96.—Highly magnified section of epidermis of a Jonathan Leaf, showing stomata.

Functions of the Roots.

The roots have two offices to perform, viz., to hold the tree firmly in the soil that it may resist the wind, storms, &c., and to supply it with liquid food.

During the periods of growth the roots are constantly forcing themselves downwards and outwards through the soil in search of the food they require.

When the points of the leading roots of the Northern Spy variety have extended beyond a few inches in length they invariably send out numerous lateral root hairs which absorb sap, and act as tributaries to the main channels.

The numerous root hairs, which branch off from the main roots in the various directions, are composed of extremely soft, spongy, delicate

cell tissue. The growing points of these young roots or food seekers have to advance through the soil by forcing their way through its pores or interspaces.

The continuous cellular multiplication which takes place at its feeding point enables the root, under the protection of a membraneous covering-sheath or root-cap, to force its way through the soil in the manner described.

Plate 91, Fig. 1, shows a highly-enlarged longitudinal section of the point of a feeding root of the Northern Spy variety, the root-cap of which was removed during the process of mounting prior to the specimen being photographed. The rounded cells at the growing point are visible, as is the vascular tissue composed of elongated cells which run longitudinally. Fig. 1 (a) is the natural size of this section. Fig. 2

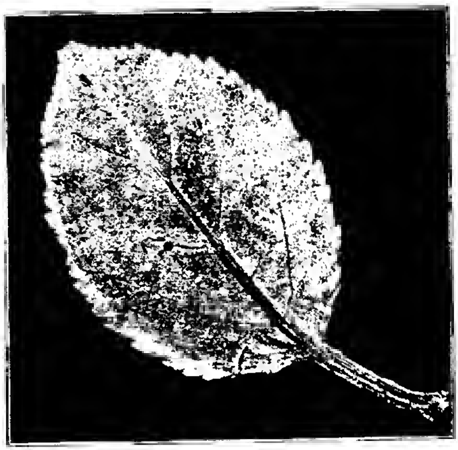


Plate 97.—Leaf of the Prince Alfred variety from which moisture and chlorophyll have been removed.

is a cross section of a similar root. It clearly depicts the cell formation, pith, &c., and was taken from the root at the point (b) Fig. 1. Fig. 2 (a) is the natural size of this section.

The feeding root, as it passes through the soil, absorbs in the state of solution by the process of osmosis the various elements which enter into the tree's food. Amongst the principal constituents are sulphur, phosphorus, silicon, lime, potash, soda, &c. Nitrogen is also taken in by the roots for, although there are large quantities in the air, it cannot be absorbed by the leaves.

As well as taking in by osmosis the sap food required to build up the tree, certain cell sap in the form of acid is given out by the root. The object of giving out this acid is to dissolve certain earthy matters which the tree requires as food, but which are insoluble in soil water in the ordinary way. The elaborated sap in the tree contains carbon.

and other matters in higher proportions than does the crude sap, as a result of the transpiration of the superfluous water from the leaves. This renders it denser than the sap prepared to be taken in from the soil. In the endeavour to establish an equal density between the sap in the tree and that without osmosis continues actively during the period of growth.

Plate 92 gives the point of the root illustrated in Plate 91, Fig. 1. But, as it is much more highly enlarged, the cells which build up the root in the direction of its length are more clearly shown.

As the walls of the cells of a feeding root consist of a very delicate membrane the sap taken up from the soil passes freely through it on to the sap-wood of the stem and branches, and thence to the leaves, where it mixes with the gaseous food taken in from the air.

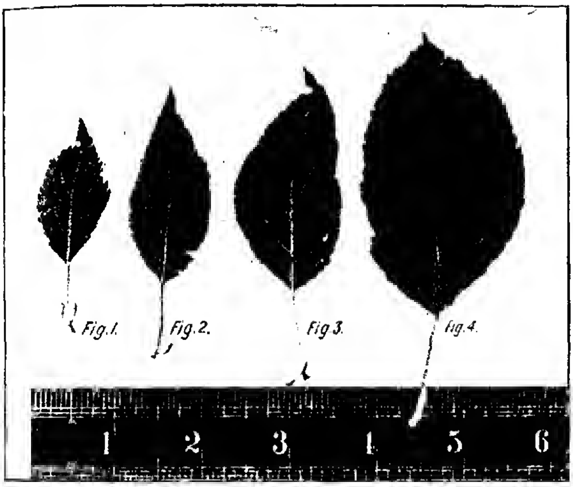


Plate 98.—Leaves of a Jonathan tree, showing development.

The Stem.

It has been stated that the sap-wood forms the channel through which the sap passes from the feeding roots up to the leaves.

Plate 93, Fig. 1, illustrates a cross section of the stem of a one-year-old Jonathan tree, the natural size of the section being 3-16 inch in diameter. The pith is (a), sap-wood (b), cambium (c), bark (d), and the parallel bundles of strands which run longitudinally and radiate outwardly is the medullary rays. During the first year of the growth of the stem the sap passes up through the pith, the cells of which show so distinctly in the illustration, as well as through the sap-wood, while the cambium gradually moves outwards. During the second and succeeding years, however, little or no sap passes up the pith or through the hardened wood.

Fig. 2 is also Jonathan wood, but two years old, and its natural size was ¼-inch in diameter. The pith (a), which has practically ceased to act as a sap channel, is narrower than that in Fig. 1. This is due mostly to the pressure exercised on it by the ring of two-year-old wood. The sap wood (c), cambium (d), and the bark (e) correspond with those marked (b), (c) and (d) respectively in Fig. 1.

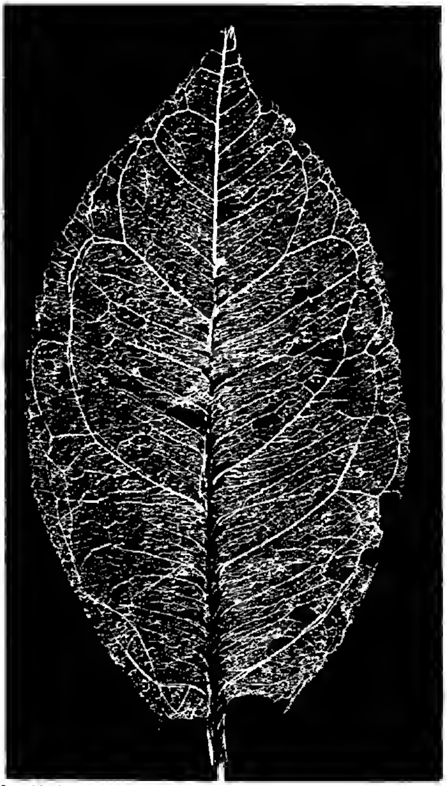


Plate 99.—Skeleton of upper surface of an Emperor Alexander leaf.

The gradual outward movement of the cambium enables it to retain its connexion with the channels through which it is essential the returning elaborated sap should flow, and this facilitates its even distribution through the tree.

Plate 94, Figs. 1 and 2, are longitudinal sections of one-year-old and two-year-old Jonathan wood respectively. These show the various strands and tissues of the stem in the direction of their length.

Functions of the Leaves.

The leaves are so arranged in the tree's structure in relation to the sap-wood and to the cambium that they are enabled to receive the crude sap through the medium of the former channel, and to distribute it when elaborated by means of the latter to the various parts of the tree where new structures are being built up.

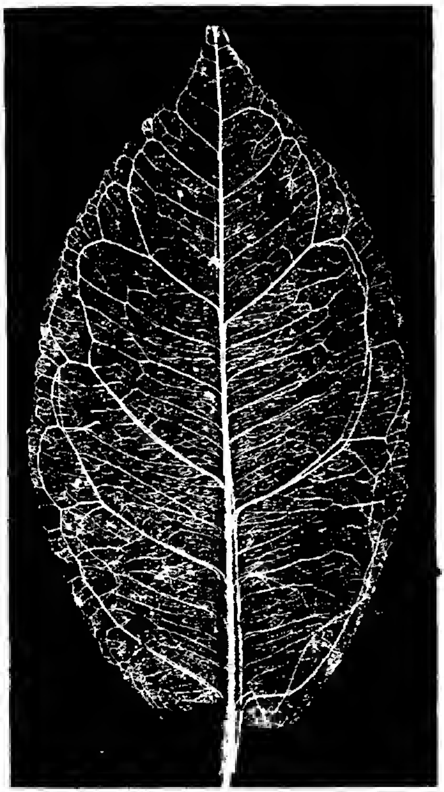


Plate 100.—Same leaf as in Plate 99, but showing under surface.

When the liquid food ascends to the foot stalks of the leaves it is passed on the midribs and by means of the lateral ribs to the veins and veinlets, which in turn supply the cell tissue in the upper surface of the leaves. Here the crude sap meets with the carbon which the leaves obtain by breathing in carbonic acid from the air through the stomata in the leaf epidermis during the day time while they are open.

Under the influence of the sunlight, and through the agency of the chlorophyll or green colouring matter in the leaves, this mixture of crude subsances becomes assimilated. While this process is in progress, the surplus water in the form of vapour and undesirable gases are given out to the air. As the sap becomes elaborated it is collected up by the veins on the under surface of the leaves and, transferred to the channels through which it is carried downwards to build up the new structures.

Plate 95 shows three Jonathan leaves, natural size, illustrating the upper surface (Fig. 1), and the under surface (Fig. 2), while Fig. 3 shows the foot stalk with stipules, and its continuation, the midrib, also the lateral ribs removed from the pulpy cell tissue of the leaf as appearing in Fig. 4.

Plate 96 is a highly-enlarged section of the epidermis of the under surface of a Jonathan leaf showing the stomata or breathing pores through which the carbonic acid is taken in from the air, and through which the leaves give off their waste.

Plate 97 is a leaf, natural size, of the Prince Alfred variety, which, while fresh and green, was boiled in a strong solution of caustic soda, and afterwards bleached until it was white and dry, prior to being photographed. By this means the green chlorophyll, which plays such an important part in sap elaboration, was removed. Compare this illustration with the leaves in Plate 95, which contained chlorophyll when they were photographed.

Plate 98 illustrates leaf development. These leaves are of the Jonathan variety and they depict Figs. 1, 2, 3, and 4, four of the last stages of leaf development respectively. Fig. 1, the smallest specimen, shows a leaf which has emerged from the embryonic stage, and is of considerable assistance in elaborating the tree's food, while that in Fig. 4 is fully grown and with maximum working power. These leaves are of an inferior stunted character, and they were all taken from the same tree, which is growing in poor, undrained soil. Note how unfavorably these specimens compare with those of the same variety in Plate 95. The latter were taken from a tree growing in rich, well-drained soil under which congenial environment the foliage, black spot having received attention, is invariably healthy and vigorous. This matter will receive further consideration in connexion with cultivation, manuring, irrigation, and drainage later on.

Plate 99 shows the under surface of a skeletonized leaf of the Emperor Alexander variety. This leaf was subjected to acid treatment by which the pulpy cell tissue was removed, while the net work of ribs and veins remain intact.

Plate 100 is the under surface of the same skeleton.

(To be continued.)

STANDARD TEST COWS.

Report for Quarter ending 31st March, 1917.

During the quarter 56 cows completed the term, of which number 49 qualified for the certificate.

One new herd has entered—that of Mr. A. H. S. Schier, of Caldermeade.

Individual returns are as follow:—

MRS. A. BLACK, Noorat. (Jersey.)

Completed since last report, 8. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Opaline	3578	26.4.16	3.5.16	273	11½	5,074	5·11	259·43	250	295¾
Grey Girl ..	2064	29.4.16	6.5.16	270	4½	4,796	5·48	263·06	250	299¾
Mona's Pearl ..	3577	1.5.16	8.5.16	273	9	5,469	5·07	277·62	250	316½
Flashlight ..	1972	5.5.16	12.5.16	270	4½	6,106	4·81	293·78	250	335
Marguerite ..	3576	10.5.16	17.5.16	266	4	6,282	4·47	281·01	250	320¼

DEPARTMENT OF AGRICULTURE, Werribee. (Red Poll.)

Completed since last report, 8. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Panama	Not yet allotted	31.3.16	7.4.16	273	26	8,658	4·33	374·61	[illegible]0	427
Carribea	"	10.4.16	17.4.16	273	14	7,414	4·18	310·10	250	353¼
Alesia	"	15.4.16	22.4.16	273	19	6,315	4·43	280·08	175	310¼
Australiana ..	"	20.6.16	27.6.16	273	14	4,582½	4·63	212·28	200	242
Phillipina ..	"	24.6.16	1.7.16	273	14¼	7,069	4·68	330·61	250	377

C. FALKENBERG, Elliminyt. (Jersey.)

Completed since last report, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Annie of Turinga ..	Not yet allotted	16.6.16	23.6.16	273	13	5,689	5·86	333·32	250	380
Silver Queen of Turinga	"	23.6.16	30.6.16	273	6	5,207	5·02	261·62	250	298¼

GEELONG HARBOR TRUST, Marshalltown. (Aryshire.)

Completed since last report, 3. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Gipsy Maid II. of Sparrovale	2511	17.5.16	24.5.16	273	12	5,859	4·35	255·00	200	29[illegible]
Gaiety of Gowrie Park	2875	17.5.16	24.5.16	273	14½	6,849½	4·65	315·42	250	359¼

TREVOR HARVEY, Boisdale. (Jersey.)

Completed since last report, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Sparkle	2978	15.5.16	22.5.16	273	18	6,483	5·85	379·36	250	432½
Kirsty V. ..	Not yet allotted	22.6.16	29.6.16	273	14½	5,237½	6·01	314·73	175	358¾

A. W. JONES, Whittington. (Jersey.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Buttercup ..	875	25.6.16	2.7.16	273	26½	8,927	4·25	379·28	250	442¼

C. G. KNIGHT, Cobram. (Jersey.)

Completed since last report, 4. Certificated, 4.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
My Queen of Tarnpirr	Not yet allotted	5.1.16	12.1.16	273	16½	4,707½	5·67	267·06	175	304½
Doreen of Tarnpirr	2982	17.5.16	24.5.16	273	16	5,643	5·44	307·11	200	350
Sweetbread of Tarnpirr	Not yet allotted	31.5.16	7.6.16	273	11½	5,240½	4·99	261·29	175	297¾
Romany Lass ..	2563	8.6.16	15.6.16	273	13½	6,038½	5·32	321·15	250	366

C. G. LYON, Heidelberg. (Jersey.)

Completed since last report, 5. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Hawthorn of Banyule	1064	1.4.16	8.4.16	273	12	5,717	4·89	279·56	250	318¾
Silver Audrey ..	1378	16.4.16	23.4.16	273	14	5,909	5·31	313·78	250	357¾
Hawthorn II. of Banyule	3619	3.5.16	10.5.16	273	8½	5,281	4·99	263·78	250	300¾
Milkmaid 37th ..	1222	23.5.16	30.5.16	273	18	7,598½	5·14	390·59	250	445¼
Velveteen II. ..	2927	28.5.16	4.6.16	273	16	7,400	4·62	341·68	250	389½

MUHLEBACH BROS., Batesford. (Ayrshire.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Camellia of Retreat	2615	26.4.16	3.5.16	273	11½	6,686	4·20	280·84	200	320¼

J. D. READ, Springhurst. (Jersey.)

Completed since last report, 16. Certificated, 16.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Lupin of Springhurst	Not yet allotted	29.3.16	5.4.16	239	16	5,003½	5·28	*264·61	200	301¾
Princess of Springhurst	2521	15.4.16	23.4.16	273	9¼	7,324	5·66	414·27	250	472½
Princess Defiance of Springhurst	Not yet allotted	17.4.16	24.4.16	273	7	5,742	5·61	322·10	200	367¼
Graceful Magnet of Springhurst	2058	27.4.16	4.5.16	273	4½	6,569½	5·08	339·91	250	380¾
Grannie of Springhurst	2059	2.5.16	9.5.16	273	6	5,351	6·03	323·01	250	368¼
Alsyke of Springhurst	1515	20.5.16	27.5.16	273	16	6,654	4·81	319·89	250	364¾
Daisy of Springhurst	1788	22.5.16	29.5.16	250	3½	4,994¼	5·39	269·29	250	307
Trefoil of Springhurst	Not yet allotted	24.5.16	31.5.16	273	9½	5,898½	5·69	335·88	175	383
Buttercup of Springhurst	3702	2.6.16	9.6.16	273	7½	6,285½	5·87	368·98	250	420¾
Solanum of Springhurst	Not yet allotted	8.6.16	15.6.16	273	8	5,509	4·95	272·81	175	311
Cobea of Springhurst	„	13.6.16	20.6.16	273	13½	6,387	5·14	328·33	175	374¼
Hyacinth of Springhurst	3705	16.6.16	23.6.16	273	8	4,786	5·77	276·03	250	314¾
Tulip of Springhurst	2730	18.6.16	25.6.16	273	6	5,965	5·30	316·06	250	360¼
Czarina of Springhurst	Not yet allotted	21.6.16	28.6.16	273	11½	5,411	5·34	289·15	175	329¾
Boronia of Springhurst	„	24.6.16	1.7.16	264	4	5,035	5·24	263·89	200	300¾
Iris of Springhurst	3706	25.6.16	2.7.16	273	8½	5,687	5·42	308·36	250	351¼

* Sold before completion of term.

W. WOODMASON, Malvern. (Jersey.)

Completed since last report 6. Certificated, 6

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Purity IV. of Melrose	1324	23.4.16	30.4.16	273	11	4,698	5·69	267·39	250	304¾
Lassie Fowler IV. of Melrose	Not yet allotted	26.4.16	3.5.16	273	22	7,843	5·43	425·54	200	485
Mystery VIII. of Melrose	3664	6.5.16	13.5.16	273	19½	6,434	6·10	392·49	250	447½
Empire IV. of Melrose	3639	7.5.16	14.5.16	273	25½	8,745½	5·43	474·68	250	541¼
Laura VI. of Melrose	3658	17.5.16	24.5.16	273	17½	7,746½	5·39	417·61	250	476
Pearl III. of Melrose	Not yet allotted	7.6.16	14.6.16	273	6½	4,927½	6·44	317·18	200	361¼

THE MILLING OF WHEAT IN VICTORIA.

By P. Rankin Scott, Chemist for Agriculture, and F. G. B. Winslow, Milling Expert.

Here in Victoria, where, in normal years, the wheat yield is so much in excess of our home requirements, the question of the disposal of the surplus is one demanding full consideration. It must be distributed either by export in its natural state or by milling the grain and exporting the flour. From a commercial point of view it is, of course, more desirable that wheat should be milled here rather than that the grain should be sent away whole, for not only does the milling give employment, but further, the various bye-products are required by our poultry rearers and dairy farmers for feeding purposes. Our principal market in normal times is Great Britain, and during the past year a considerably increased tonnage of flour was shipped there. In the oversea markets the Victorian miller has to compete, not only against his British rival's goods, but also against the flour shipped from other parts of the world, for the British miller draws his supplies from almost all the grain-growing countries. Therefore, he is able to blend the wheats as occasion demands, and thus mill a high-grade flour, and the science of blending having been raised to a fine art, he can supply the British baker with an ideal baking flour. Grain exported by us is largely used in blending in order to give the flour quality and class. As Australian wheat is so highly prized for blending—our flour, properly milled, should hold its own in the markets of Great Britain, as well as in other parts of the world. In order that the present reputation of our Australian wheats may be preserved, the flour exported should be graded, and only the best quality allowed to be shipped as No. 1 Australian.

In milling a high-grade flour much depends on the treatment given to the grain in the mill. Wheat, as it is received at the mill, contains approximately between one and two per cent. of impurities, which, of course, are of no value for milling into flour. Besides these impurities there is always adhering to the beard of the berries a quantity of dust and earthy matter, which must be removed before the wheat can be considered fit for the conditioning process.

Wheat Cleaning.

When the wheat is received at the mill, it is passed through a warehouse separator to eliminate the bulk of the dust and earthy particles, and to remove the larger pieces of straw, &c. During this operation a large amount of dust is raised by the action of the fans, and some portion of it is not retained by the dust collectors, but floats through the air in the vicinity of the separator. Impregnating the air inside the mill with this foreign body should be avoided as much as possible, and in order to save trouble through this dust-laden air being drawn into the other wheat-cleaning machinery, the operation is best carried on outside the mill. After passing through the separator the wheat is passed on to the silo for storage, and thence is run through a milling separator as required for milling. This latter machine is designed on much the same principle as the warehouse separator. A thinner stream of wheat

is fed to the milling separator which, being filled with sieves of a finer mesh, longer time is required to treat the grain, making for a more complete separation of the smaller pieces of straw, husks, &c., that have escaped the warehouse separator. The next operation is to run the wheat over a magnet to catch any pieces of iron wire or metal that may have escaped the separators. It is then passed through the cockle and small-seed cylinder, to remove grass seeds, &c., and next through the barley and oats cylinder. By this time the wheat should be comparatively clean and free from the different larger impurities common to all bulk samples of wheat. The process of cleaning the berry has now to be performed, and in this work careful treatment is necessary. The first step is to pass the wheat through an emery scourer, and this treatment removes most of the particles of dirt still adhering to the berry, and releases through the action of the beaters some of the beeswings and beard of the berry. To remove the portion of beeswings and beard released during the previous operation and give a final polish to the berry the grain is run through the brush machine, and after being treated here it is ready for the conditioning bins.

Conditioning.

The cleaning and conditioning of wheat is to-day recognised as second only in importance to the milling itself. The object of conditioning is to bring the wheat into a homogeneous condition, and that condition is obtained when the component parts of the wheat grain are of the same hardness, and the moisture content of the berry is uniform. The first step in the process is to "know your wheat." Suffice it to say that no "rule-of-thumb" method should be attempted if a consistent quality of flour and offal is required, and if a high standard of colour and yield is to be maintained; at the same time, of course, millers are advised to adhere to the conditions which are found in practice to be the most advantageous. There are changes in the wheats, and in the weather conditions, that require attention. Wheat is a hygroscopic substance, that is, it possesses the power to some extent of absorbing moisture from the air. The amount of water required to condition the wheat will be regulated by the moisture of the wheat and by climatic conditions at the time of treatment.

Wheat well conditioned will give the best results, not only under the rolls, by breaking in a free manner without cutting up the bran, but will return a maximum quantity of semolinas and middlings. Victorian-grown wheat absorbs moisture quickly, and necessary precautions should be taken to prevent too much water being absorbed, or to allow the grain to remain for too long a time in the conditioning bin. Should the stock become hot and sweaty on the rolls as a result of either of these conditions, the milling operations will be faulty, and the flour of low grade, as regards colour and quality. Wheat well conditioned will return a stronger flour than the same wheat indifferently conditioned. The actions begun inside the berry by conditioning are at present not fully understood. Speaking generally, the effect of moisture and heat is to set up a process of fermentation, which affects the flavour of the flour. If the wheat be milled at the proper time, a sweetish flavour is imparted, while if it is allowed to remain

too long before being milled, a secondary acid fermentation may take place, having a detrimental effect on the flavour of the flour. It would be advisable, in order to have some control of this process of conditioning, to keep a record of the quality of the wheat, the bushel-weight before and after conditioning, the length of time between damping and grinding, the temperature during the operation, and the baking quality of the flour. The difficulties attendant on the control and proper working of this operation are not so great in this State as they are where the wheats are more varied in physical and chemical characteristics. Local-grown wheats are mostly of the soft-grain class, and they have a fairly uniform absorption. Differing climatic conditions during the season of growth will have some effect on the absorption capacity of the wheat.

Two methods are at present in use in this State for conditioning the grain preparatory to milling. The more common one is by means of the damping worm. The water added is regulated by a tap at the head of the worm, and meets the flow of wheat, which in the onward movement becomes thoroughly damped. After treatment in the damping worm, the grain is run into the conditioning bins, and is left there sufficiently long to enable the moisture to penetrate into the heart of the berry—and this makes for as even a moisture content as possible throughout. When the desired temper is reached, the wheat is passed through a steamer to toughen the bran, and is then ready for the break roll.

The modern method of treatment is deserving of more attention. The wheat, after having been dry-cleaned as already described, is then passed through a washing machine. Washing the grain has been found to be the most effective manner of treating smutty or bad-smelling wheats. After washing, the grain is rinsed in clean water and passed through a whizzer, and this operation removes most, but not all, of the adhering moisture. It has, therefore, to be passed through a conditioner and afterwards sent to the conditioning bin, where it is allowed to lie from two to six hours. This conditioner may also be used to advantage in conjunction with the usual method of damping with a worm conveyor.

Wheat, after being conditioned, is in a sensitive state, and is liable to shed some bran dust. It is, therefore, necessary to pass it through a brush machine to remove any dust before it reaches the break roll.

Breaks.

The modern roller mill is a model of fine workmanship. The framework and mechanism are made strong to bear the great pressure set up during the grinding operations. The rolls have a chilled-iron surface and a spindle of toughened steel to withstand the tensile strain. The surface of the rolls is sawtoothed and fluted with grooves about half the depth of the stock to be ground. The rolls are run at differential speeds, and the fast one has a downward cutting edge, and the holding roll a sharp edge, against the direction of rotation. The feed gear is very sensitive, and by means of a lever can be made to deal with varying classes of material. The feed enters a hopper at the back of the rolls, and is spread into a thin even layer by means of spring gates and twin rollers. The rolls are fitted with a very sensitive micrometer adjustment, and can be set to 1-1000 of an inch. The general practice is to

obtain as much semolina and middlings as possible on the first and second breaks, without cutting up the bran or making break flour and bran dust. When this is done, the feed to the third break will be broad and thin, and the middlings adhering may be removed on this break. The stock coming to the bran roll will have some flour adhering, which will require very little pressure to release. A small percentage of flour will be separated, and clean broad bran will tail over from the bran duster. On the breaks, as well as on the reductions, the exhaust should be adjusted to remove the hot air without drawing off any of the good stock through excessive suction. Heating of the rolls should not be permitted, as keeping the stock cool makes for a better finished flour. Cutting up of the branny particles must be avoided, or the purifiers will be overworked, and a low-grade flour be the result. The first, second, and third break rolls are run at a differential of $2\frac{1}{2}$ to 1, with a speed of 350 revolutions per minute, and the fourth break roll at a differential of 3 to 1, with a speed of 450 revolutions per minute, the rolls being grooved as follows:—First break, 12; second, 14; third, 20; and the fourth, 26 grooves to the inch.

Reductions.

The reduction rolls are usually numbered in alphabetical order from A to L. Stock as it reaches the reduction rolls should be granular and as pure as it is possible to make it. The best stock should grade on to C roll. This roll has the largest grinding surface of any of the reduction rolls. At least, 20 per cent. of the flour, or approximately 50 per cent. of patents, should be made on it. The roll surface necessary on each reduction roll in order to mill Australian wheat at the rate of 500 lbs. per hour would be approximately—A, 7″; B, 9″; C, 11″; B^2, 3 ; D, 7″; E, 5″; F, 5″; G, 4″; H, 3″; I, 3″; K, 3″; L, 3″: total, 63 inches.

The feed sent to A reduction is the bulk of the semolina. This should be bright, clean, and sharp in appearance, and free from branny particles. The object to be attained on this roll is to grade the coarse semolina, allowing as much as possible to pass on to C roll, without releasing a high percentage of flour. A better quality of flour is got through giving the feed this double treatment. Attempting to reduce the stock in one operation would lower the quality and the strength of the flour. The roll should be set, to return a sharp grind, not less granular than the C feed. The offal will consist largely of germ that has been flattened out, and will be easily removed by the purifiers.

The feed sent to B reduction is the throughs of the middlings' purifiers, except those from the tails and the head sheets of these purifiers. The same method of grinding is carried out here as at A roll in order to make stock for C roll. The grind will be more even and finer and comparatively sharp. Provided the purifiers are doing their work satisfactorily, very little impurity and more flour of a better quality will be made here than at A roll.

B^2 roll is required to deal with the tails from B redresser and the throughs of the tail sheets of the third break purifiers.

The stock graded on to C roll should be small, sharp, and free from impurities. The grind should be soft, and the hardness only detected

on rubbing the grind through the fingers and thumb. The object to be attained here is to have as big a release of flour as possible without impairing its quality, and the setting of the first two reductions should be made with this purpose in view.

After C roll, no fixed method of treatment can be laid down, the flow sheet in every mill varying more or less. A detailed examination would to a great extent be similar for the stock and the working of the rolls. It should be borne in mind that the stock should be kept as sharp as possible, although it will not be practicable to avoid a certain amount of flaking after passing the C roll. As F and I rolls deal with stock of a fibrous and germy nature, any undue pressure, instead of making the yield from the tails better, will cause flaking, which will not only lessen the quantity of flour obtained, but will also lower the colour and affect the keeping quality of the flour. The X or scratch roll is specially designed to treat semolina with pieces of bran adhering. If such were allowed to pass to the smooth rolls without further treatment, it would lower the colour of the flour. This roll has about 32 grooves to the inch, and is run at a differential speed of 2 to 1. This roll requires careful adjustment, for, if set too close, both the pure and the impure stock will be cut up. The scratch roll is a valuable addition to the reduction system. By its use the percentage of flour may be increased approximately by 2 per cent., and its colour is much better.

Scalping, Purifying, and Dressing.

The grind from the break rolls are subjected to scalping, purifying, and dressing, in order to prepare the stock for further treatment at the breaks or reductions, as the case may be.

Scalping is the method by which the semolina, middlings, and flour are separated from the broken wheat, and the separation should be as complete as possible.

The old method of reels, rotary and centrifugal, have all been found to have shortcomings. In some mills they are still being used, but the tendency is growing of replacing them by the plansifter, largely on account of the more gentle treatment given to the stock and the number of separations it is possible to make on one machine.

The purifiers are nearly all of the sieve pattern. The stock travelling over sieves of different mesh is purified by a current of air drawn up through the sieves. Careful adjustment and attention are necessary to make for good work during the operation. Centrifugals are probably the best all-round flour-dressers. They have a tendency to break up flakes, and, where pure stock is used, will dress out more flour.

The plansifter may be used with advantage on stock from A reduction grind. Through allowing a greater number of separations, the stock will go to C roll in a more uniform condition.

On the breaks the aim should be to separate the endosperm from the bran in as uncontaminated a condition as possible. The chop, on reaching the scalpers, is separated at the first operation by means of wire covers, the tailings passing over to the next break for further reduction. The endosperm is graded by means of grit gauze of different mesh into coarse and fine semolina, coarse and fine middlings, and flour. After

leaving the scalpers, the coarse and fine semolina is sent through a redresser to remove any particles of flour. The removal of the flour facilitates the treatment of the stock on the purifiers. If the stock is not graded on the scalpers, it becomes more difficult to work the purifiers effectively, as the stock may vary in volume, specific gravity, and form.

Grading also insures the separation of the pure from the impure particles. First and second break stock may be treated together on the same purifiers, but the third break stock, being of different size and quality, must be treated separately. Lightness is usually associated with impure stock or stock of little value. The tail sheets of the purifiers are covered, so as to send the impure stock to the offals or lower reductions.

In all systems of purification a certain surface space is allowed per sack per hour of the mill capacity. Different wheats require different surface space, light stocks requiring more than heavy. Australian wheats require about 800 sq. inches per sack. The separation depending largely on the size of the particles and the specific gravity—the heavier stock will pass through the covers, while the lighter particles will tail over, and the still lighter particles be drawn up by the suction of the fan and deposited in the tins. The grind from the fourth break is not allowed to mix with the stock from the other three breaks. The chop of this break consists of bran and from 10 to 15 per cent. of fine middlings and flour, and it is necessary to scalp this on 36-wire. The throughs of the scalpers are of poor quality, and the flour should be removed on fine-number silks to avoid contamination of the bulk flour. All small stocks from this scalper are generally sent to the K reduction.

The grinds from A to L differ in regard to quality and quantity.

Flour Dressers.

Flour dressers are covered with different numbers of silk, starting with a coarse mesh at the head and getting finer towards the tail end of the mill. Fine mesh is essential at the tail end, as the stock becomes poorer in quality and finer in size of particles and consequently there is more danger of some of the offal dressing through with the flour, thereby spoiling its colour and lowering its quality. To insure a clean finish the grind at the tail of the mill requires a greater dressing surface in proportion to the amount of the stock treated than the grind from the earlier reductions. In the dressing machines, dunst sheets and cut-offs are used to divide the tailings into two grades. It is at the tail end of the mill where their real value may be seen. Stock that will not readily dress through as flour is passed over a dunst sheet. The good stock will then pass through for further reduction, and the inferior tail over into the offals.

Effect of Cleaning the Berry on Quality of Flour.

The tables on pages 355, 356 and 357 have been compiled in order to show the effect of cleaning the berries in the baking and doughing quality of the flour produced from them.

Table I shows the results of experiments made with flour of the different breaks and reductions from wheat not washed before entering

the conditioning bins, while Table II gives details of the tests obtained from the flour of the different breaks and reductions from wheat washed before entering the conditioning bins.

The main points to be observed are—

(1) The chemical tests do not show any marked difference in the strength and gluten contents of the flour from the same reduction of the mills.

(2) From both mills a better quality flour is obtained from C reduction than from A and B reductions.

(3) In the final portion of the mill the flour possesses higher gluten and strength.

(4) The flour from L reduction is particularly high in strength and gluten, and is similar in all respects to that obtained from milling a macaroni wheat.

(5) About 3 per cent. of the quality of flour referred to in (4) was obtained from each milling.

(6) The withdrawal of the L reduction from the bulk would tend to improve the colour of the flour without perceptibly reducing the strength.

(7) There is a marked falling off in baking qualities after E reduction is passed.

It is very noticeable that there is an improvement in the volume, texture, and colour of the loaves made from the flour milled from washed wheat, and it is evident that the more thorough cleaning of the berry has improved the baking quality of the flour. The point is particularly worthy of note, for too much attention cannot be paid to the cleaning operations if the best quality baking flour is to be produced from our ordinary F.A.Q. quality wheat.

RESULTS OF CHEMICAL AND PHYSICAL TESTS ON FLOUR FROM NO. 1 MILL.

No.	—	Strength—Quarts Water. 280 lbs. Flour.	Wet Gluten.	Dry Gluten.	Flour.	Moisture.	Colour—20 points max.	Quality of Wet Gluten.
			%	%	%	%		
1	F.A.Q. ..	50·4	20·87	7·49	100·0	11·61	19	Fairly tough, elastic. Fairly easy to collect
2	1st, 2nd, and 3rd break meal re-dresser	47·8	21·90	7·70	7·3	11·19	16	Tough. Fairly elastic. Easy to collect
3	1st, 2nd and 3rd break fine middling duster	49·0	23·09	9·08	11·3	10·89	16·5	.. .. ..
4	4th break ..	48·2	24·07	9·71	3·1	10·98	14	,, ,, ,,
5	A. Reduction ..	47·0	15·6	5·0	13·3	10·67	15	Weak, rotten. Hard to collect
6	B. ,, ..	48·8	17·97	5·56	15·5	10·46	10	,, ,, ,,
7	C. ,, ..	48·2	20·05	5·72	15·8	10·05	18	,, ,, ,,
8	D. ,, ..	53·0	22·40	6·85	9·5	10·10	20	Fairly weak and flabby
9	E. ,, ..	52·0	21·06	7·06	3·2	10·30	20	Weak at first. Finest washing. Fairly tough. Elastic
10	F. ,, ..	51·6	22·17	7·03	3·0	10·16	17	Tough. Elastic
11	G. ,, ..	52·4	26·00	9·19	5·0	10·46	17	Fairly tough. Fairly elastic
12	H. ,, ..	52·6	23·65	8·47	3·6	10·76	16	Fairly tough and elastic
13	J. ,, ..	52·4	22·48	7·96	2·1	10·81	7	Hard to collect at first. Fairly tough at finish
14	K. ,, ..	54·0	30·35	9·55	3·6	10·92	8	Very tough and elastic
15	L. ,, ..	54·8	30·30	10·90	3·0	11·75	4	,, ,,
16	2 Scratch roll..	46·2	22·40	8·14	0·8	11·20	19·5	Tough. Elastic

Results of Chemical and Physical Tests on Flour from No. 2 Mill.

No.	—	Strength—Quarts Water, 200 lbs. Flour.	Wet Gluten.	Dry Gluten.	Flour.	Moisture.	Colour, 20 points max.	Quality of Wet Gluten.
			%	%	%	%		
17	F.A.Q. mill ..	49·4	19·39	6·32	100·0	12·12	20	Tough. Elastic
18	1st break ..	46·4	19·04	6·10	3·4	12·48	15	,,
19	2nd ,, ..	46·0	19·04	6·80	3·8	11·92	16	,,
20	3rd ,, ..	47·0	23·50	8·56	4·6	11·18	20	Fairly tough. Elastic
21	4th ,, ..	47·0	27·99	9·96	3·1	10·70	16	Very tough and elastic
22	× Scratch roll ..	47	19·40	6·69	0·8	11·53	16	Fairly tough and elastic
23	Coarse middlings duster	46	17·20	6·16	1·8	12·06	15	,, ,,
24	Fine middlings duster	46	23·12	8·15	5·0	12·37	20	Tough and elastic
25	A. Reduction ..	46·4	16·15	5·00	12·4	12·21	16	Fairly weak
26	B. ,, ..	46·5	17·80	5·38	14·7	12·16	17	Weak at start of washing. Tough at finish
27	C. ,, ..	49·2	19·40	6·64	15·0	11·99	20	Hard to collect at start. Finish tough
28	D. ,, ..	52·0	21·11	7·33	9·0	11·50	19·5	Fairly tough. Elastic
29	E. ,, ..	54·4	22·24	7·55	2·7	11·13	19	,,
30	F. ,, ..	51·0	21·46	8·03	2·5	11·27	18	,,
31	G. ,, ..	52·4	23·15	8·14	4·5	11·08	19	,,
32	H. ,, ..	54·2	25·70	8·71	3·6	11·00	17	,,
33	J. ,, ..	50·0	23·20	7·44	2·1	11·04	17	,,
34	K. ,, ..	51·4	29·00	10·33	3·6	11·34	15	,,
35	L. ,, ..	53·0	28·43	9·36	3·0	11·36	12	,,
36	B2. ,, ..	49·0	17·54	6·22	3·6	11·54	18·5	Wet gluten. Soft. Inclined to be ragged

Baking Tests, No. 1 Mill.

No.	—	Colour, 20 points max.	Texture, 20 points max.	Weight of Loaf, grams.	Volume.	Water Absorbed in Doughing.	Points for General Appearance.	Remarks.
					c.cm.	cm.	(20 max.)	
1	F.A.Q. mill ..	17	20	489	1,480	218	20	Very good spring in oven. Worked well in dough. Very good crust and colour
2	1st, 2nd, and 3rd break meal re-dresser	16	19·5	472	1,450	203	20	Very good spring in oven. Very good crust and appearance. Worked fast in final stage. Inclined to clammy
3	1st, 2nd and 3rd break fine middling duster	16	20	471	1,480	203	19	Good spring in oven. Worked well in dough. Very good crust and general appearance
4	4 Break ..	16	20	473	1,480	205	20	Good spring in oven. Good crust and general appearance. Dough inclined to be slack after 1st knock-back
5	A. Reduction ..	15	20	470	1,520	199	20	Very good spring in oven. Very good appearance of loaf
6	B. ,, ..	17	20	477	1,520	207	20	,, ,, ,,
7	C. ,, ..	20	20	478	1,600	205	20	,, ,, ,,
8	D. ,, ..	20	20	490	1,600	225	20	(Half loaf baked.) Very good spring in oven. Very good crust and general appearance
9	E. ,, ..	20	20	509	1,600	221	20	Very good spring in oven. Very good crust and general appearance
10	F. ,, ..	17	18	474	1,470	218	18	(Half loaf baked.) Fair spring in oven. Fair appearance of loaf
11	G. ,, ..	17	17	489	1,475	223	18	Fair spring in oven. Fair appearance of loaf
12	H. ,, ..	16	18	482	1,480	224	18	(Half loaf baked.) Fair spring in oven. Fair appearance of loaf
13	J. ,, ..	14	15	470	1,420	212	16	(Half loaf baked.) Slight spring in oven. Poor appearance of loaf
14	K. ,, ..	11	15	489	1,480	229	16	Slight spring in oven. Poor appearance of loaf. Inclined to be foxy
15	L. ,, ..	10	11	496	1,220	232	14	Very slight spring in oven. Crust very fiery. Poor appearance of loaf
16	× Scratch roll ..	17	17	466	1,540	210	18	Good spring in oven. Crust very fiery

Baking Tests, No. 2 Mill.

No.	—	Colour, 20 points max.	Texture, 20 points max.	Weight of Loaf, grams.	Volume.	Water Absorbed in Doughing.	Points for General Appearance.	Remarks.
					c.cm.	cm.	(20 max.)	
17	Straight run, F.A.Q. mill	19	20	475	1,580	210	20	Very good spring in oven. Very good crust and general appearance of loaf
18	1st break ..	17	17	468	1,550	198	17	Dough became weak and running in trough. Fair spring in oven
19	2nd	17	18	465	1,540	195	18	Good spring in oven. Crust very fair. Inclined to be foxy
20	3rd	17	18	470	1,510	209	20	(Half loaf.) Good spring in oven. Good crust and appearance of loaf
21	4th	17	18	478	1,530	209	20	Good spring in oven. Good crust and appearance of loaf
22	Scratch roll..	17	17	474	1,700	209	18	Dough inclined to run. Very good spring in oven. Crust slightly foxy
23	Coarse middling duster	18	18	479	1,660	193	20	Dough inclined to run. Very good spring in oven. Good crust and appearance
24	Fine middling duster	18	18	476	1,780	193	20	Very good spring in oven. Very good crust and appearance of loaf
25	A. Reduction ..	18	19	477	1,520	197	19·5	(Half loaf.) Good spring in oven. Good crust and appearance of loaf
26	B.	19	19	481	1,570	201	20	Very good spring in oven. Good crust and appearance of loaf
27	C.	20	20	485	1,600	209	20	Excellent spring in oven. Dough worked very strong in trough. Excellent crust and appearance
28	D.	20	20	491	1,620	221	20	" " "
29	E.	20	20	494	1,610	231	20	" " "
30	F.	20	20	476	1,560	217	19	(Half loaf.) Very good spring in oven. Worked well in dough. Good crust and appearance
31	G.	19	20	480	1,540	222	19	Good spring in oven. Crust inclined to be fiery
32	H.	18	20	487	1,500	230	19	Good spring in oven. Crust fiery
33	J.	18	20	479	1,480	212	19	(Half loaf.) Good spring in oven. Crust very fiery
34	K.	12	17	475	1,445	218	17	Fair spring in oven. Crust very fiery
35	L.	12	17	485	1,340	225	17	Worked very slow in trough in first stage. Fairly fast in last stage. Very slight spring in oven
36	B2	19	20	455	1,580	208	20	Very good spring in oven. Good crust and appearance of loaf

The wheat produced every year in the European countries at war is ten times as much as the greatest harvest ever reaped in Australia, and thirty times as much as Victoria's record wheat harvest. The average total amount of wheat produced in Europe during this period, 1901-1910, was 1,657 million bushels per annum, whilst the total world production for the same period was 3,233 million bushels per annum. *In spite of this stupendous production, Europe's net imports average no less than 244 million bushels per annum, every European country except Russia and the Balkan States being importers.*

Thorough grading of seed is vitally necessary on every wheat farm. Grading of seed with a good machine not only removes weed seeds, grains of other cereals, rubbish, damaged and cracked grain, and thus separates material of considerable commercial value for feed, but of negligible value for seed, but the graded residue is more prolific than the ungraded product.

AGRICULTURAL TEACHING AT THE UNIVERSITY.

Report of Committee appointed at the December meeting of the Council, on the recommendation of the Faculty of Agriculture, to consider the following points:—

1. The success achieved in the University teaching of Agriculture here and elsewhere in respect to the number of students who have availed themselves of the course and have become (*a*) farmers, pastoralists, orchardists, &c.; (*b*) experts in the Departments of Agriculture and elsewhere; (*c*) teachers of agriculture. If the success in Australia in training such men has not been encouraging, what has been the cause of the non-success?
2. Whether a single degree course in agriculture in Melbourne should be continued, or whether courses narrower in scope but more specialized and advanced in treatment (such as cereal culture) should be substituted for it in the future.
3. What type of training would best qualify students to become expert officers of the Agricultural Departments?

Your Committee begs to report that it held eleven (11) meetings (eight during the long vacation), at which the members attended as follows:—

Professor Laby	..	11	Professor Lyle	..	3
Mr. Richardson	..	11	Professor Masson	..	1
Dr. Green	..	11	Mr. Purves	..	1
Professor Skeats	..	10	The Vice-Chancellor		1
Dr. Cameron	..	10	Mr. Carlisle	..	1
Professor Ewart	..	6			

Mr. Maxwell was co-opted and attended six meetings, and on one evening Professor Watt, of the University of Sydney, was present by invitation of the Committee, which desires to thank him for his willing assistance and for the valuable information he gave both then and subsequently by letter.

Further advice and statistics were sought and obtained from Professor Paterson, of the University of Western Australia, and from the Registrar of the University of Sydney and the Registrar of the University of Adelaide. A circular letter was sent to all available graduates of the course, asking for information and opinions.

The material obtained from these different sources has been discussed by the Committee, and the substance of it included in this report.

I.

With reference to the success achieved in the University teaching of Agriculture here and elsewhere, and as to the cause of the lack of

support that has been accorded to it, your Committee begs to report as follows:—

UNIVERSITY COURSE IN AGRICULTURE.

1. Melbourne.

Since the inauguration of the University course in agriculture in Melbourne, in 1907, 57 students have entered the course. Of these, twenty have obtained the degree of Bachelor of Agricultural Science, and one the diploma. In addition, fifteen others have substantially completed their Agricultural Course, whilst two transferred to the Veterinary Course, and one to the Science Course.

Of the 35 students who graduated or substantially completed the Agricultural Course—

(*a*) One is engaged in farming.
(*b*) Nineteen have become teachers (sixteen of whom are in the Education Department).
(*c*) Eight have entered the Department of Agriculture.
(*d*) Two have taken technical positions outside the State.
(*e*) Three (together with eleven others included in the above lists) are on active service.
(*f*) No definite information could be obtained as to the occupations of the other two, but it is unlikely that they are engaged in either farming or teaching.

2. Sydney.

The Agricultural Course at Sydney University commenced in 1910; since then 27 students joined the classes. Nine have graduated, and, in addition, three others have substantially completed the course. Of these twelve, one secured the Rhodes Scholarship, another the 1851 Exhibition Travelling Scholarship, and the third was awarded a Walter and Eliza Hall Fellowship. Only one graduate intended to go on the land, but he, in common with the majority of the graduates, enlisted. In the University of Sydney, the students, before presenting themselves for their degree, must attend for four years at the University and spend their summer vacation at various State experimental farms, whereas the undergraduates of Melbourne University have been required to spend three years at the University and one unbroken year at Dookie Agricultural College.

3. Western Australia.

The Agricultural classes opened in 1914, since when "nine students have entered or signified their intention of entering the degree or diploma courses. At present, most of these have gone to the war."

4. Adelaide.

The University is affiliated with the Government Agricultural College at Roseworthy for the purpose of conferring a degree of B.Sc. in agriculture, but in ten years only six students have taken the degree, and there are at present no students taking the course. Mr. Peter Waite has recently bequeathed part of his valuable estate at Glen Osmond for the assistance of agricultural education at the University.

5. QUEENSLAND.

Up to the present, no course in agriculture has been established.

6. UNITED STATES.

In the United States considerable success has attended the establishment of University courses in agriculture. In 1910, 3,060 students were taking a four-years' course in agricultural science at the Universities, and no less than 707 graduated in the same year. The total number of graduates in all schools at the Universities of the United States in 1910 was 6,807. If Victoria had the same ratio of students in proportion to population as the United States, there would be 44 students taking the degree course in agriculture at the University, and there would be ten graduates each year.

7. PRUSSIA.

In Prussia there are six institutions of University rank giving an agricultural course, and at these the average annual number of students since the foundation of this course till 1912 was 1,767.

Summary.

The success achieved in the University teaching of agriculture here and elsewhere in respect to the number of students who have availed themselves of the course obviously falls short of the standard obtaining in such countries as America and Germany. It must, however, be borne in mind that the number of students compares very favorably with the attendances in the early years of other schools of Australian Universities.

Such a comparison is made in the following table:—

Age of Course.	Engineering at Sydney University.		Agriculture at Sydney University.		Agriculture at Melbourne University.	
	Date.	Total No. of Students.	Date.	Total No. of Students.	Date.	Total No. of Students.
1st Year	1883	3	1910	4	1907	4
2nd Year	1884	7	1911	7	1908	8
3rd Year	1885	2	1912	11	1909	20
4th Year	1886	3	1913	15	1910	24
5th Year	1887	8	1914	10	1911	30
6th Year	1888	9	1915	13	1912	26
7th Year	1889	6	1916	9	1913	19
Average attendance per year	..	5·4	..	9·9	..	18·7

Thus it will be seen that at Sydney University the average number of students attending the Agricultural School during the first seven years of its existence has been 9.9, as compared with an average attendance of only 5.4 the first seven years of their Engineering School. This latter, in its nineteenth year, had a roll call of 99 students.

The average attendance for the first seven years of the Agricultural School of the Melbourne University has been 18.7 students, but, as illus-

cated by the attached graph, the attendance dropped in the eighth, ninth, and tenth years to seventeen, eleven, and four respectively.

It may be noted that in 1908 the Education Department initiated its policy of sending teachers to the University to be trained in agricultural science, so that they might give agricultural teaching at the Agricultural High Schools.

In 1911 the first student graduated, and towards the end of the year Professor Cherry was appointed. At this time, also, the Education Department, which had been sending up three or four teachers to the course each year, abandoned this policy, and graduates and teachers found no demand (or remuneration) for their services.

At the end of 1914 the course was considerably modified, and war broke out.

In the opinion of the Committee, the School of Agriculture at the Melbourne University has not attracted in recent years as large a number of students as might have been expected, mainly on account of the want of remunerative openings for graduates at the completion of their course. The Committee is of the opinion that the school will continue to fail to attract students unless a career with a reasonable emolument is open to graduates in agricultural science.

Those graduates who are not teachers, and who have remained in Victoria, have entered the Department of Agriculture, and after two or three years' service are filling temporary positions as field officers at salaries of £144 to £200 per annum. No one will voluntarily take up agriculture who is called upon, after gaining the degree, to put in an indefinite period at such inadequate remuneration.

We are firmly of the opinion that the falling off in the number of students entering is largely due to the failure of the graduates in agricultural science to obtain emoluments, comparable with those of graduates in other courses which have the same entrance examination, and require the same length of time for graduation, *e.g.*, veterinary science, law, and engineering.

So far as the present course is concerned, the Committee is of the opinion that it has not succeeded in training farmers. The course was not, however, designed for this purpose, as the agricultural colleges provide special facilities for such training.

Although a reasonable proportion (8) of the graduates have from time to time found employment in the Agricultural Department, this has been at a remuneration incommensurate with the value of the useful scientific work they have carried out. More of this work is urgently required.

Several graduates of the course gave promise of making their mark in agriculture, but some of these were lost to agriculture by reason of more adequately paid work in allied branches of science. (Two of the most brilliant have fallen in the war.)

It is to be regretted that the majority of the graduates employed in the Education Department have not been engaged in teaching agriculture, but have been mostly occupied in teaching other subjects in primary and secondary school work. Insufficient weight would appear to be given to the training in agricultural science when making appointments or considering promotions. It would appear that this result is

inevitable under the system of appointments required by regulations framed under the Public Service Acts.

The Committee is of the opinion that the principal objective of the course should be to train agricultural scientists who will attain expert knowledge of principles and methods, and apply themselves to increasing the agricultural output of the State. The future progress and prosperity of the State largely depend on the extent to which agricultural production can be increased. This can be brought about—

(1) By the wider diffusion and application of existing knowledge in all branches and in respect of all phases of plant and animal industry.

(2) By the acquirement, by means of experiment and research, of new knowledge which will form a basis of future improvements in the practice of agriculture in Australia.

The majority of the men trained in the course should be engaged in these spheres, either as instructors, demonstrators, or research workers.

The responsibility for improving the technical knowledge of the farming community, and of increasing the agricultural output, is usually assumed by the State, and some countries, particularly the United States, Germany, and France spend large sums of money and have complex organizations for achieving these objectives.

The State Governments of Australia have established in their Agricultural Departments, organizations whose principal object is the stimulation of agriculture, and thus it is in the service of the State Departments that the main opportunity for the agricultural scientist lies.

The Committee is convinced that it would be a sound investment for the State Government to provide for, and utilize, at least six scientific graduates in agriculture per annum, who would find employment in the Agricultural Department, Education Department, and State Rivers and Water Supply Commission.

We therefore recommend that the Government be asked to undertake to give positions to at least six such graduates per annum for the next five years in these three Departments. That these graduates be appointed for a probationary period of six months, and given an honorarium of £100, after which, if their services be retained, they be paid a salary of not less than £300 per annum. It is confidently expected that within five years the influence of the utilization of men with an agricultural training will have been successfully demonstrated.

Another cause militating against the success of University teaching of agriculture is the lack of touch between the University and the man on the land. The Committee is of the opinion that the principle should be adopted of appointing professional specialists as part-time lecturers, as in the faculties of medicine, law, and engineering. In the case of agriculture, it is probable that the only specialists available in the immediate future will be officials of the Department of Agriculture. Already arrangements are being made to utilize such specialists for the lecture courses in veterinary, hygiene, and agriculture.

The Committee recommends that other officers of the Agricultural Department be appointed to act as part-time lecturers in those subjects in which it is most desirable that the lecturer should be in close touch with the application of his branch of agricultural science to the industry.

Such subjects are dairying, plant pathology, entomology, farming of irrigated lands, &c. The Committee feels that the adjustments that this arrangement might require of the Agricultural Department would be recouped by the supply it would afford of well-trained junior officers to recruit the Department.

It may be recalled that successful professional men accept University lectureships in medical and other subjects.

II.

Whether a Single Degree Course in Agriculture should be continued or whether it should be replaced by Specialized Science Courses.

The present course aims at a degree which connotes a knowledge, up to University standard, of the foundation sciences underlying agriculture, and of the application of these to agriculture to the extent of insuring proficiency in the various forms and branches of the art.

From the evidence of graduates it would appear that, to some extent and in certain directions, this aim has not been attained. Your Committee also, from its investigation of the work done, finds itself in a position to support the contention that the course has not been so apt and thorough as was necessary to achieve the best results. Indeed, it is somewhat surprising that such a comparatively satisfactory position as detailed earlier in this report should have resulted when the adverse conditions under which the course has been carried on are considered.

Within the University, the drawbacks have all been such as are attributable to lack of means. The Government grant of £1,000 per annum was absorbed by the salary and allowances to the professor. From the general University funds, provision was made for the teaching of agricultural chemistry and for other minor teaching. Beyond these, the course was not supported financially. The majority of subjects for the examinations had to be taken in classes designed for other courses—medicine, science, veterinary, engineering, &c. Botany, geology, physics, physiology, and the like science subjects were taught, but without specialization in an agricultural direction. Neither was it possible to provide instruction of the special character necessary in such subjects as dairying, animal husbandry, viticulture, horticulture, cereal culture, veterinary practice and entomology. Furthermore, there was no provision of a laboratory or class room, apparatus, or equipment for the teaching of agriculture.

For these reasons, which are attributable almost solely to want of financial means, the course has lacked the special character and thoroughness necessary to the full realization of its aim.

The very gratifying success of those graduates who have been employed by the Department of Agriculture in the attainment of so high a degree of proficiency as has been testified to by the Director of Agriculture and the Agricultural Superintendent is a tribute to their capacity and assiduity under adverse circumstances, rather than to the provision made for their proper training by the State.

Under these circumstances, your Committee cannot recommend the continuance of the present course with the present lack of means for its proper and genuine accomplishment. But it *does recommend* that the

scope of the present course be maintained, and that adequate provision be made for teaching it. From all sources that have been available to it has come indorsement of your Committee's firm and unanimous conviction that a well-carried out University course of degree standard in agricultural science is, now more than ever, essential to that acceleration of progress in agricultural industries without which the State will be unable to meet the national obligations imposed upon it. While there may be artificial devices capable of stimulating agriculture, genuine and permanent increase of output from the land can only follow on the application of agricultural practice of the teachings of the sciences, and even such devices must be aided by improved farming practice for them to realize their most advantageous results.

The application of science to agriculture requires a body of agricultural science, research workers, and evangelists, the former to attack problems and the latter to urge and accomplish the practice of methods demonstrably certain to increase output and profits; and we have the testimony of leading officers of the Department of Agriculture here, as well as the experience of America, Germany, and Denmark, to show that the possessors of an advanced agricultural education are the only persons who can successsfully carry out the propaganda necessary to transform those who at present farm "by the light of nature and the rule of the thumb" into diligent followers of the profitable practices dictated by the achievement of science.

Your Committee therefore recommends the continuance of the course for the single degree in agricultural science, conditional on the Government undertaking to appoint annually six graduates, and on adequate arrangements being made for the laboratories, equipment, and additional staff required to teach the subjects indicated with * in the course set out below. These additional lecturers may or not be members of the present staff, but special courses should, after the first year, be given to the agricultural students.

As the arrangements and details of subjects are by Statute and custom of the University, matters to be decided by the appropriate faculty, it may be pointed out that the syllabus set out is given in order to amplify and make clearer the nature of the Committee's recommendations.

Suggested Degree Course in Agricultural Science.

First year—

- Chemistry, Part I.
- Natural philosophy, Part I.
- Botany, Part I.
- *Agricultural zoology.

Second year—

- Attendance for practical course, as prescribed by Faculty, at State Research Farm, Werribee, over four full days per week during the year, and also
- *Animal physiology.
- *Veterinary science and stock breeding.
- *Dairying.

* NOTE.—The subjects indicated thus are subjects not at present provided for, and additional lecturers should be appointed in these subjects.

Third year—
- Agricultural chemistry.
- *Agricultural botany.
- *Agricultural geology.
- *Agriculture.
- *Entomology.
- *Plant pathology.

Fourth year—
- *Agriculture.
- Agricultural bio-chemistry.
- Agricultural engineering.
- *Horticulture (principles).
- *Viticulture (principles).
- Agricultural bacteriology.
- Animal hygiene and dietetics (veterinary course).

It is considered probable that arrangements could be made with the Government whereby Mr. A. E. V. Richardson, Agricultural Superintendent in the Department of Agriculture, could also be appointed Professor of Agriculture in the University, half his services being given to each position.

It is also considered necessary that the teaching on the agricultural side should be strengthened by the utilization of such of the officers of the Department of Agriculture as can be made available.

Apart from the advantage to the course to be gained by the co-operation of officers of the Department of Agriculture, this plan will result in a closer union of interest between the University and the Department, which cannot be other than beneficial to the cause of agricultural education.

The proposal to have the second year of the course passed at Werribee instead of Dookie, as heretofore, will enable the students to get the necessary practical training and farm atmosphere, while at the same time allowing them to keep in touch with the teaching staff and undertake three subjects for examination, which will relieve the present congestion throughout the three University years.

The estimated total expenditure for the special staff required is £1,500 per annum; a further sum of £250 per anum for contingencies and travelling expenses will be required.

Equipment.

As stated before, no provision has hitherto been made for an Agricultural School or class-room, and your Committee considers it essential that such provision should be made. For the present it is thought that a building comprising a class-room, demonstration-room, specimen-room, and office will suffice, and that the cost of such a structure would be about ..	£1,500
Necessary apparatus and equipment would absorb another	500
Students' quarters at Werribee Farm	750
	£2,750

* Note.—The subjects indicated thus are subjects not at present provided for, and additional lecturers should be appointed in these subjects.

III.

Your Committee considers that if the course submitted above be adopted, such a course will afford the kind of scientific training most suitable as a groundwork, from which specialization as departmental officers may be developed.

Summary.

Your Committee reports and recomends:—

1. That a general course in agricultural science is desirable, and that the graduates of such a course would be capable of rendering valuable service as experts in several Government Departments and elsewhere.
2. That the present course has not recently succeeded in attracting students mainly owing to lack of encouragement and of remunerative employment for its graduates.
3. That the present course be modified as set out in the syllabus given above. This will entail the following:—
    (*a*) That Mr. A. E. V. Richardson, M.A., B.Sc., be appointed half-time Professor of Agriculture, and several other officers of the Agricultural Department as part-time lecturers in special subjects.
    (*b*) That the farmwork in the second year of the course be carried out at the Werribee State Research Farm instead of at Dookie College as at present.
    (*c*) That a special building be erected at the University for agricultural purposes at a cost of £1,500.
4. That the Government be asked—
    (*a*) To provide a sum of £2,750 for immediate expenditure on buildings, &c., as set out in the report. This includes £1,500 mentioned in 3 (*c*) above.
    (*b*) To provide an annual grant of £1,750 for salaries of professor and lecturers and for apparatus.
    (*c*) To undertake to appoint annually for the next five years at least six graduates (under the conditions previously set out) in the Departments of Agriculture, Education, and State Rivers and Water Supply.

This report was unanimously adopted at the last meeting of the Committee held on 28th March, 1917.

On behalf of the Committee,

(Signed) T. H. LABY, Chairman.
HEBER GREEN, Secretary.

ECONOMIC TREATMENT OF FARM SLAUGHTERED ANIMALS.

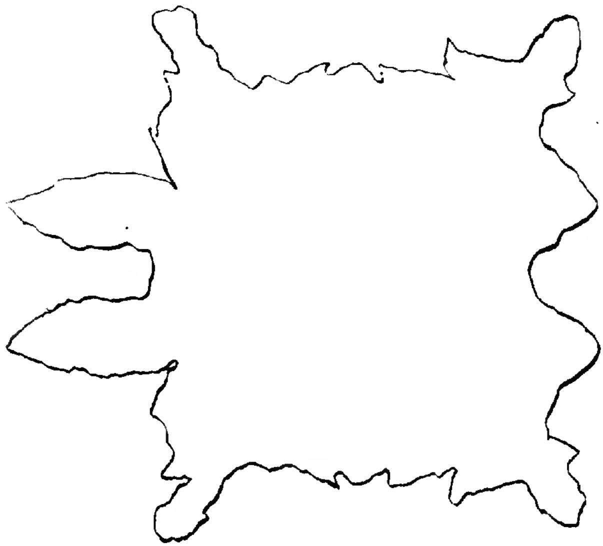
By J. C. Marshall, Inspector of Stock.

In a previous article attention was drawn to meat waste, and consideration is now given to the economy of the various other products obtained from the slaughter of farm animals. These, generally speaking, are inferior to the beasts marketed. "Sell what is marketable and eat what you cannot sell" is one of the unwritten laws of the farmer.

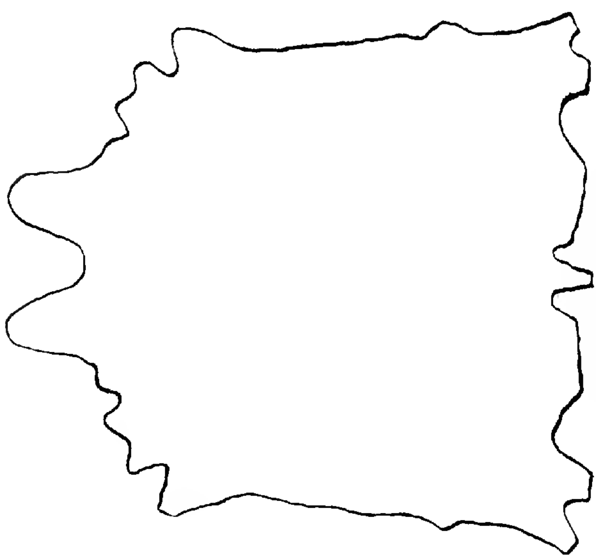
Probably one of the greatest losses he suffers is due to bad skinning or flaying, especially in the case of cattle hides. Knife marks, cuts, ragged edges, and bad shape, together with the fact that they occasionally reach the market in a putrid condition, always spell loss, and many thousands of pounds annually are lost from this cause.

In the flaying of large or small cattle the proper opening up of the beast is all important, as the ultimate shape of the skin or hide depends on this operation. Probably one of the best methods after sticking and carefully pumping the animal is to skin the head and then put the carcass on its back and prop it in that position by means of a pritch or blocks. Open the skin from crutch to neck in a direct line. Remove the fore feet at the knees and the hind feet at the hocks. Open the skin at the inside of fore-legs to the point of the brisket and at the hind legs from hock to scrotum. Always skin tail and leave about 6 inches of it on the hide. Should the tail be cut out with the skin attached to it, not only a most valuable piece of hide from the butt is lost, but, further, the shape of the hide as a whole is spoilt. The dressing is accomplished by means of a good sharp butcher's knife, saw, and chopper. In flaying, one of the main factors is to hold the skin up tight with one hand and drive or thrust the knife with the other. This is done by forcing the knife between the hide and the flesh per medium of the panniculus or "felm." After opening the carcass out on the ground and skinning well down each side, saw through the brisket and aitch. Hang up carcass and finish skinning; after removal of stomach, entrails, and pluck, saw or chop down evenly through the back bone. Use as little water as possible for cleansing, and make sure that it, as well as the cloth used, are clean.

After washing the hide free from blood and *débris*, sprinkle well, especially at the edges, with clean coarse salt. Fold it up by throwing in sides to centre, then neck and tail end, and roll up. Efficient, clean, and quick salting is necessary, as many putrid "farm" hides reach the city skin stores. Farm-stored hides should be laid away flesh side up in shallow concrete pits, and treated well with clean salt. They will there make their own brine, and will keep till ready for market, when they may be rolled up. It should be remembered that clean hides fetch from ½d. to 1d. per lb. more than dirty hides.



Shape of a Badly Flayed Hide.



Shape of a Well Flayed Hide.

Dressing Calves.

In dressing calves for farm use the simplest way to bleed the animal is to lay it on its side and with one clean cut across the neck sever all the blood vessels. Next hang up carcass and by slitting the skin from crutch to neck and ringing about the tail open belly carefully, so as not to puncture the intestines. Remove entrails and stomach and split down brisket, then remove pluck. Use no more water to clean than is required. It is not necessary to completely skin the calf at time of slaughter, as portions can be skinned as the veal is required for use, especially in the cool weather.

A portion of the stomach of the calf not ordinarily saved by farmers is in demand just now. This is commonly known as the Rennet or Vell, from which the calf rennet extract is derived. It is the fourth stomach of the calf, and is sometimes pickled in strong brine of salt and water, and is the agent employed to convert milk into curd for cheese making. Owing to the present war conditions, the ferment usually employed has risen considerably in value, and there is now a keen demand for calf rennets.

The Victorian Government cheese expert advises all country calf-killers to save the vells, and recommends the following method for procuring and preserving them. After disembowelling the calf, lay stomachs and intestines out on a clean board or table, and cut away the intestines a few inches from where they enter the stomach. Separate the fourth stomach from the others, and squeeze out contents, but do not wash out. Fill vells up with coarse salt and allow to dry. After drying, shake out superfluous salt and pack away in small barrels after sprinkling salt between the layers. Another method is to blow up and tie the open ends, and allow to dry after the fashion of bladders, but care must be exercised to prevent them from being fly-blown.

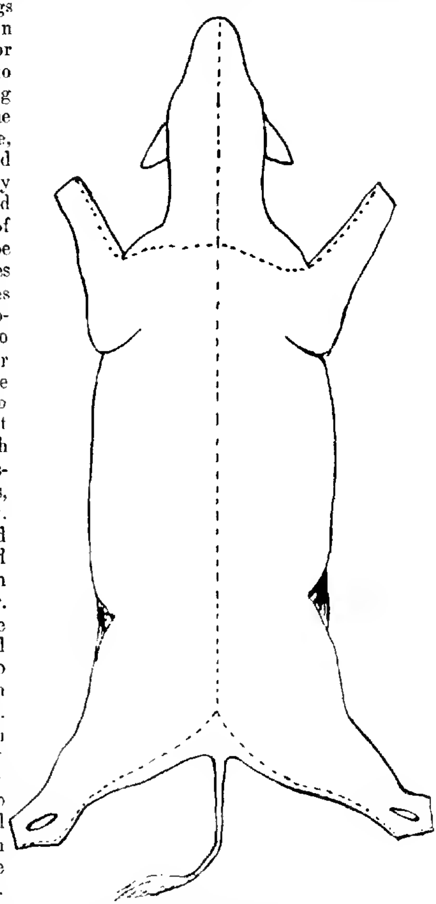
Sheep and Lamb Dressing.

The knife is not used all the time in removing the sheep skin or lamb pelt. After "legging" the animal, that is, clearing round the head, knuckles, and hocks by means of the knife, hang up, split the skin from pelvis to neck, and use the fist and elbow to remove the skin. It may, however, be necessary to use the knife a little to clear round the tail. After a few trials it will be found that the pelt will peel off easily. Sheep skins should be hung fleshy side up in a shady cool place to dry. If it is necessary to keep till several are available for market, paint with arsenical solution to prevent attacks by weevils.

Pig Dressing.

Probably the most important feature in farm pig killing is in regard to the scald. It is well known that should the scalding water be too hot the hair sets and the cleaning process is much prolonged, and the work generally badly finished. The sticking operation can be carried out in several ways, and care should be exercised not to "shoulder" the animal. In shouldering the pig the knife severs most of the blood vessels in the neck, but, instead of going into the chest cavity, it slips along the outside of the ribs and enters the shoulder, where blood clots lodge to the detriment of the meat. Small pigs may be held in a sitting

position and then stuck. The knife should be driven in the neck in front of the breast bone, towards the heart, making a deep but small incision. Large pigs must be thrown on their sides and stuck while in that position. Pigs may be scalded in tubs, barrels, or tanks, according to size and number being slaughtered at one time. If possible, enough water should be used to nearly cover the animal, and the temperature of the water should be between 140 degrees and 150 degrees Fah.; this heat is obtained by using two parts of boiling water to one of cold. Place the carcass in the tub or barrel and keep it moving as much under water as possible. The tail, ears, and feet clean first. A few well-directed strokes with a scud or shovel should, in the case of a porker, remove nearly all the hair. The animal ought, if possible, to be finished off in a tub of cool water. If the scald has been a good one, very little shaving is required. Hang up and wash with cold water, and brush in order to finish the beast prior to opening. The disembowelling is done in similar fashion to that suggested for sheep and calves, but care is required to make a neat job of splitting the breast bone. Hang carcass in a cool place out of the wind, so that a good colour may be obtained. If the pig is a large baconer or chopper, it is advisable,



The dotted lines indicate the direction to be followed with knife in order to get the best shaped hide. (Figure is of a beast on its back.)

unless in very cold weather, to split down carcass immediately after slaughter and remove all internal fat or flear, including the fat attached to kidneys and aitch.

Blood Saving.

Blood from farm-slaughtered animals is usually lost. All animals for farm use should be bled on the same spot, and a small cemented pit at the end of an impervious drain used to catch the blood. This may be saved in various ways and put to many uses on the farm. It makes a highly concentrated nitrogeneous manure and well suited for kitchen or flower garden. A good method of dealing witb it is as follows:—Collect the blood free from water and boil, and then spread out on a clean marly patch of ground to dry in the sun. When dry it may be gathered with some of the marl and stored in bags and used as required.

For poultry food the blood should be collected fresh, and, after boiling, dried in the sun on sheets of iron. It can then be powdered and stored for use. This should be fed sparingly to fowls.

Although rarely used for human food purposes, it may be so employed. Healthy pigs' blood is the best for the purpose. The animal should be bled into a clean dish and the blood immediately stirred with a wisp of twigs to remove some of the fibrin, and thus prevent clotting. It may then be mixed with oatmeal, boiled barley, rice, or flour, and, after seasoning, filled into pig casings or sheep and ox bungs to make the various kinds of blood puddings.

Edible Fat.

In order to get the best results from beef fat for table and cooking purposes, it is necessary to treat it while quite fresh. All beef fat and trimmings, including the caul fat, should be saved clean, sliced, and put through a household mincer. The minced fat should then be warmed in an oven at a temperature not exceeding 150 degrees Fah. This will melt the bulk of the fat. The balance can be rendered at a higher temperature, but care should be taken not to mix the two melted fats, as that which melts at the lower temperature will be found to be of better quality, especially for table purposes. All the rougher fats, whether beef or mutton, may be rendered into tallow after washing clean and cutting into small pieces. The temperature should be much higher for tallow rendering than for edible fats, and care should be taken that the fat does not burn. When running off after straining for storage, stir well while setting, as this prevents seeding, *i.e.*, the granular condition observed when the tallow has set, and, further, the stirring will make the material keep better.

Tripes.

The portion of the stomachs known as the paunch of cattle, calves, and sheep can be used for human consumption, and, when cleaned and parboiled, is known as tripe, and the method of preparation is as follows:—First empty the stomach of contents and wash after turning inside out, and then scald in the way suggested for the scalding of pigs. Tripe should be scraped clean and white in water of a temperature of

about 150 degrees, which may be obtained by using two buckets of boiling water to one of cold. To facilitate the cleaning process the tripe may be laid out and beaten with a stick as soon as the lining begins to loosen in the scald. Scrape clean, rinse in clean cold water, and, in the case of ox tripe, boil for about five hours. The smaller tripes of sheep and calves should be boiled for a proportionately shorter period. After freeing from all superfluous fat and skin the tripe will be ready for the household.

Casings.

A fair proportion of the large and small intestines may be utilized for sausage casings. After cleaning they may be salted and saved till required for use. In the saving process the intestines are first run off from the "set" or intact lot of guts freed from adherent fat and turned by means of a turning stick. These runners are then soaked in luke-warm water and scraped perfectly clean of the mucous lining by means of a piece of bone or wood on a level and flat board. Finally they are packed in salt and stowed in barrels till required for use.

Bones.

Bones may be utilized on the farm, either for cattle or poultry food. While the bones are fresh and green most of the softer ones may be ground and fed to poultry as ground green-bone. If required for cattle, they may be burned, and the calcined result pulverized and mixed with the food.

Hair.

Hog hair, cow tails, and other hair in marketable quantities has a commercial value. Hair scraped from pigs should be sundried before putting into bags.

Other Products.

Calves' heads and feet, ox feet, and sheep trotters are first prepared for human consumption by scalding. The scalding method is similar to that used for preparing tripe, and the temperature is roughly the same. Ox heads and feet require a little higher temperature in the scald than calves' heads and feet. After striking the scald, place in luke-warm water and scrape clean, using a blunt knife and large table-spoon for the purpose. Finish off by shaving with a very sharp knife

Neatsfoot Oil.

Calves' feet, ox feet, and sheep trotters, after scalding, may be further boiled for the oil which they give off. After boiling in water for a few hours the oil will float on the water. This may be skimmed off and stored in bottles.

At City Abattoirs practically everything that is derived from the animal is utilized. About the only portion of which use is not made is the paunch contents, and at some of the works even that is subjected to special treatment, being pressed in hydraulic or screw presses to free it from moisutre, when it is dried finally and used as fuel.

BREEDING FOR THE DAIRY.

By R. R. Kerr, Dairy Supervisor.

Cattle breeding is a comprehensive study, and has reached a high state of excellence in some countries. To the dairy student the excellence of the cattle coming from Ayrshire, in Scotland, Holland, and the Jersey Islands provides matter for thought, as year after year many of their best animals have been exported to distant lands, but still they are able to maintain that high standard of excellence which has made them famous. The only possible solution seems to be that these qualities are strongly inherent, as the result of countless generations of line and inbreeding. The breed had to be synonymous in every way with the people who inhabited these lands, famous for their frugality and saving capacity. In early times, and up to the present day, they exercise the greatest care in the selection of their dairy sires, and societies have been known to prohibit the exportation of a sire that was thought to be an acquisition. So many females have to be served by bulls winning certain prizes. The same conditions apply to many bulls leaving the Islands. Almost any pure sire will improve a grade herd, but it takes more than ordinary skill to select a sire to improve a pure herd already of high excellence. All pedigreed males are not suited for sires, and probably more than half of those born should be eliminated by a process of selection.

Intelligent breeding is done with a definite purpose in view, having in mind at all times the ideal one aspires to. In the case of a young bull, it would be folly to use such a sire lacking in most of the essential points that go to make constitutional perfection, although his pedigree and performance behind him were of the best, since such a sire is nearly sure to transmit some of his physical defects to his offspring, irrespective of his dam.

Breeding is carried on to perpetuate the breed and to produce variations in certain desired directions. If there were no variations, there would be no improvement. However, heredity gives one the only possible assurance that variations will not be spasmodic, but fixed. Good physical qualifications in the selection of a sire are of the utmost importance, as physical defects generally come out in the next generation. Cows that produce an abnormal flow of milk or butter must of necessity have a good constitution. Sires should possess to a marked degree the inheritance of prepotency, and it behoves the breeder, when selecting one for his registered herd, to secure an animal that is as nearly physically perfect as possible, as well as great production behind him, thus combining the two factors that a dairy animal should possess—"type and production." A bull's value as a sire is to be judged by the average quality of his progeny, and not by the excellence of isolated members. Instances are on record when a bull has made a great name for himself by siring some wonderful producers, but when searching investigations have been made, there has been a greater number of failures. Then, again, some bulls kept in large herds have greater opportunities for proving their value, while others have been used only on a few cows. The only fair comparison is by the average quality of the progeny. Many of our best sires have been destroyed before their value was known. The impression generally prevails that when a bull is six years old his period of usefulness has ended, but such is not the case; when judiciously used he is fit for service to at least twelve years of age.

Such periods are very short for the majority of dairymen, who allow the bull to waste himself by running with the cows. They value him as a great worker, instead of the producing ability of his offspring. Auction sales are usually not the best place to secure a dairy bull; there gather some of the greatest collections of useless, injured, and mongrel animals it is possible to imagine, where their value is based on the number of calves they can sire in a season, and sold to the accompaniment of the common expression—splendid calf-getter.

BERSEEM OR EGYPTIAN CLOVER.

By R. T. McKenzie, Dairy Supervisor.

A fodder which is coming into great favour with northern irrigation farmers as a winter feed for stock is berseem or Egyptian clover.

Although not very widely known here, it has been grown with highly satisfactory results in some of the other States, particularly South Australia. According to Professor A. J. Perkins, of the South Australian Department of Agriculture, who introduced it to this country, berseem is extensively grown in Egypt for six months of the year.

Mr. F. O. Ellis, of the Nanneella Settlement, had a very fine plot. Although somewhat late in sowing it, Mr. Ellis speaks very highly of berseem as a feed for milk cows and has been growing it for some years.

As it is a winter grower, producing an abundance of succulent fodder at a time of the year when lucerne is not very productive, its value is obvious.

The following table shows the chief component parts of berseem as well as those of other green fodders used for winter feed:—

—	Dry matter.	Protein.	Carbo.	Fat.
Berseem clover	10	2·06	4·40	·12
Green lucerne	20	3·7	12·3	·6
Green oats	38	2·7	22·7	1·0
Green barley	21	1·9	10·2	·4
Mixed pasture	20	2·6	10·6	·5

Berseem is low in fibre and carbohydrates, has a high water content and, like all fodders with a high percentage of water, stimulates the flow of milk. If fed in conjunction with lucerne hay or oaten chaff, it should furnish a good ration. The best time to sow is in February or early in March at the rate of about 20 lbs. to the acre. The ground should be well cultivated and a good dressing of farmyard manure is an advantage. If this be not available the use of an artificial fertilizer in the shape of superphosphate is advisable.

In the irrigation areas it is considered necessary to flood the land immediately prior to sowing to insure a regular germination.

The first cut will be ready seven or eight weeks after sowing, and will yield 6 or 7 tons of green feed to the acre, the subsequent cuts, of course, being lower.

Berseem should do well in the southern parts of the State, where autumn rains are assured.

HOW FRANCE IS STIMULATING AGRICULTURAL PRODUCTION.

The following is a translation of a circular issued by the French Academy of Agriculture, and reproduced in *La Revue de Viticulture* (Paris), of 8th March last:—

"*Appeal by the Academy of Agriculture to the Farmers of France.*

"Our agriculturists have not remained content with answering the call of the country and fighting to defend the liberty and the rights of France; they have struggled with the same valliance to assure the food of the civil population as of our troops. We know what men, women, and even children have done in this respect, and how magnificent is the effort which they have developed.

"To the hard work already done, to the services already rendered to the homeland, a new effort must to-day be added, and agriculturists will merit once again the esteem as well as the gratitude of their country.

"Even foreign nations suffer from the crisis which now exists in all our country districts; hands are scarcer because labour is more sought after in the factories which produce munitions of war; agricultural production is more difficult and food prices are rising. Necessary purchases become day by day more onerous, if not more difficult, and transport charges are increasing.

"To save France from fresh expense, and in order to consecrate to the National defence all our financial resources, it is from the land of our country that new products must be demanded, it is to the farmer that an appeal must be made to draw from our soil all that it can give.

"To maintain, to assure, to develop even, our agricultural production is to-day a necessity, it is a work of patriotism and of reason.

"The Government understands this. It states it at the present hour: in order to furnish labour to all our cultivators it has just decided that agriculturists of the 1888 and 1889 classes shall be mobilized to the soil (not to the front). It is also doing its utmost to favour the transport of manures and to increase their production, notwithstanding difficulties arising from the needs of National defence in chemical products. It has obtained from the Senate the ratification of the double bonus for wheat culture, which will permit farmers to receive for each quintal (220 lbs.) the sum of 36 francs (28s. 10d.), and to draw, in addition, 20 francs for each hectare cropped over and above the previous year's area.

"Let land-owners, farm managers, and agricultural labourers understand on their part the *rôle* they have to play, the services which they can render, and the duties which are imposed upon them.

"In the assurance of being preserved from the sufferings of famine and from the anxiety which would be caused by deficient yields, the entire population will wait with calm the approaching hour of victory.

"By rendering this even more certain, the French agriculturist will indeed have 'merited of the homeland.'"

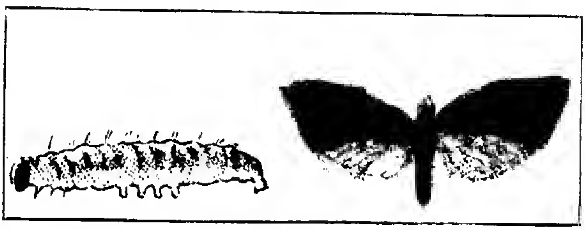
(Sgd.) Jules Develle, President.
A. Haller, Vice-President.
Henry Sagnier, Perpetual Secretary.
G. Wery, Vice-Secretary.

AN ORANGE GROVE PEST.

By S. A. Cock, Orchard Supervisor.

A pest noticed in various orange groves in the State since December last, and which has now become very troublesome, has been identified by the Government Entomologist (Mr. C. French, jun.) as the light brown apple moth (*Cacœcia responsina*). From my own observations it would appear that its method of attack on the trees is as follows:—

The eggs are laid on the rind of the fruit as well as on the leaves. The tiny caterpillar on emerging from the egg attacks the rind of the orange, generally where there is a leaf overlying and in contact with the fruit or where two or more oranges touch in a cluster of fruit. The caterpillar does not, as a rule, make its way into the orange immediately, but gnaws along the rind and eventually bores into it and feeds, to a slight extent, on the pulp, in which it forms a cavity under the rind. In any case, whether the rind is bored into and through to the pulp, or only furrowed on the exterior, premature ripening of the fruit ensues with a consequent weakening at the stem, and it falls in a semi-ripened



Moth (twice natural size) and Larvæ (magnified).

(Reproduced from *A Handbook of the Destructive Insects of Victoria*, by C. French, sen.)

condition. The caterpillar then emerges from the fallen fruit and enters the soil to go through its metamorphosis.

The moth is about ¾ of an inch in expanse of wings, and the upper pair are light brown in colour, and slightly barred, while the under set vary from a lighter brown to fawn without any markings.

The caterpillar when fully grown is about ¾ of an inch in length, and is of a light green colour.

This pest should be controlled as follows:—Spray the trees thoroughly when the foliage is dry with arsenate of lead, using a good pump with a strong power behind the nozzle, so that the spray may be forced into the interstices and over every part of the tree, and the fruit clusters thoroughly covered with the poison. All fallen fruit should be picked up daily. The soil around the trees should be frequently stirred with a light cultivator, so as to disturb any caterpillars which may be lurking there.

In view of the great expansion of our citrus industry and the serious depredations of this pest, every effort should be made by growers to combat it.

VICTORIAN RAINFALL.

First Quarter, Year 1917.

District.	—	January.	February.	March.	Quarter
		Points.	Points.	Points.	Points.
Mallee North	District Mean.. ..	102	281	74	457
	Normal	55	64	112	231
	Per cent. above normal	85	339	..	98
	„ below „	..	..	34	...
Mallee South	District Mean.. ..	78	235	70	383
	Normal	57	74	98	229
	Per cent. above normal	37	218	..	67
	„ below „	..	..	29	..
North Wimmera ..	District Mean.. ..	59	191	102	352
	Normal	64	69	95	228
	Per cent. above normal	..	177	7	54
	„ below „	8	..	..	..
South Wimmera ..	District Mean.. ..	61	179	118	358
	Normal	93	76	109	278
	Per cent. above normal	..	136	8	29
	„ below „	34	..	..	..
Lower Northern Country	District Mean.. ..	72	200	73	345
	Normal	90	81	116	287
	Per cent. above normal	..	147	..	20
	„ below „	20	..	37	..
Upper Northern Country	District Mean.. ..	91	216	97	404
	Normal	116	95	135	346
	Per cent. above normal	..	127	..	17
	„ below „	22	..	28	..
Lower North-East ..	District Mean.. ..	258	250	140	648
	Normal	154	138	224	516
	Per cent. above normal	68	81	..	26
	„ below „	..	..	38	..
Upper North-East ..	District Mean.. ..	241	503	396	1,140
	Normal	217	207	277	701
	Per cent. above normal	11	143	43	63
	„ below „	..	..	..	..
East Gippsland ..	District Mean.. ..	260	182	201	643
	Normal	256	223	241	720
	Per cent. above normal	2	..	..	..
	„ below „	..	18	17	11
West Gippsland ..	District Mean.. ..	148	243	324	715
	Normal	229	168	274	671
	Per cent. above normal	..	45	18	7
	„ below „	35	..	..	..

VICTORIAN RAINFALL—*continued.*

District.	—	January.	February.	March.	Quarter.
		Points.	Points.	Points.	Points.
East Central	District Mean.. ..	116	215	243	604
	Normal	233	174	274	681
	Per cent. above normal	..	24	..	..
	" below "	37	..	11	11
West Central	District Mean.. ..	91	190	150	431
	Normal	146	130	208	481
	Per cent. above normal	..	46	..	..
	" below "	38	..	28	11
North Central ..	District Mean.. ..	127	273	140	540
	Normal	130	122	173	425
	Per cent. above normal	..	124	..	27
	" below "	2	..	19	..
Volcanic Plains ..	District Mean ..	74	173	144	391
	Normal	139	114	176	429
	Per cent. above normal	..	52	..	..
	" below "	47	..	18	9
West Coast	District Mean.. ..	74	188	172	431
	Normal	148	124	198	470
	Per cent. above normal	..	52	..	..
	" below "	50	..	13	8

N.B.—100 points = 1 inch.

In the Mallee and north-eastern portions of the State the rains during January were in excess of requirements, as the falls were too heavy to be appreciated, especially after the three previous wet months. Over the remainder of the State drier conditions prevailed, and the totals were below average, except in the central south, where the figures were slightly above or approximated the normal. The year opened with general rains, which lasted during the first two days. These were due to monsoonal influences, and showers fell between the 4th and 9th owing to the passage of an Antarctic depression, and from the 18th to 22nd light scattered rain was recorded south of the Divide. The flood rains last year prevented early anticipations of crop records materializing along the courses of the Campaspe and Goulburn, and in some parts complete failures eventuated; but in the Mallee and Wimmera excellent harvests and some phenomenal results were realized. The delay in harvesting was not beneficial in the western and central districts, but in the north-central parts crops turned out well; and, as grass and water throughout the State were more than sufficient for requirements, the stock were in excellent condition. All northern areas in February were much above average rainfall, the Mallee receiving more than three times the usual amount, other districts more than twice the normal. These excessive rains were caused by monsoonal disturbances, which were frequent during the month. As is usual in cases of much cloud and heavy rains,

equable temperatures were experienced, and the slight difference between the highest and lowest daily readings is remarkable for the month, which is generally Victoria's warmest period. Very few districts experienced high maxima, Boort being the only place where the temperature reached 100 degrees. Except in the eastern parts of Gippsland, the rainfall was in excess of requirements. March would have been exceedingly dry were it not for heavy general rain on 29th and 30th, due to tropical influences, the heaviest falls occurring in the upper north-east division, the Mallee and northern country being below average, also all southern districts except West Gippsland. The month was a very mild one, although frosts were severe and frequent in parts, and caused some damage to the potato crop. Ploughing was, at end of month, almost general throughout the State, except in a few places where the want of a good rainfall had delayed the preparation of the soil for seeding purposes. The dairying industry was in a highly satisfactory condition, due to the increased supplies of milk consequent on the abundance of grass and water; but the mice plague has done, and is still doing, a tremendous amount of harm to hay, wheat, and oats, and shows no prospect of diminishing notwithstanding the various methods adopted to destroy this pest.

H. A. HUNT, Commonwealth Meteorologist.

THE SUNFLOWER.

CROP WORTH EXPERIMENTING WITH.

Oil-producing plants have come in for more attention of late years, especially those, such as the sunflower, that are easily cultivated and from which a good return may be expected.

Helianthus annuus is supposed to be a native of Mexico, and to have spread throughout all the temperate and sub-tropical zones. The cultivation of the sunflower is easy. From 6 lbs. to 8 lbs. of seed is required to sow an acre. The seed should be planted an inch deep, and when the plants are a foot high they should be earthed up, and need then receive no further attention. In Russia the seed is sown in drills 2 feet apart, and the plants are afterwards thinned to give about 12,000 plants per acre. Up to 16,000 plants have been successfully grown on an acre of land in England. It seems advisable to have rather wider rows—say, 28-in.—and to space the plants 15 inches apart in the rows. Horse cultivation can be carried out with this space between the rows. Topping the plants is recommended in order to increase the yield per acre.

The sunflower does best on rich calcareous soils. On really good land the yield per acre should be something like 50 bushels; and 1 bushel of seed yields approximately 1 gallon of oil. The white-seeded variety is said to yield more oil than the dark-seeded kinds.

At the Moumahaki (New Zealand) experiment farm last season a dark-seeded variety, Russian Giant, was successfully grown. The seed was planted in October, and the crop was ready to harvest early in March.

The sunflower is rather an exhausting crop so far as potash is concerned. A means to counteract this is to burn the stalks and spread the ashes over the land; it is said that the stalks grown on an acre contain from 15 cwt. to 20 cwt. of potash. An analysis of the ash of the plant (given by the *Pharmaceutical Journal*) includes, in round numbers, the following constituents:—Potash 48, lime 10, magnesia 5, and phosphoric acid 10 per cent.

The oil is of great value. Besides being used in some parts for table purposes, it is employed in the manufacture of paint (especially for greens and blues); it also makes soap of great softness. It burns well. The seed is a valuable food for poultry. The seed, shelled and ground, makes very sweet flour for bread; if roasted and ground it forms a substitute for coffee. The residue is superior to linseed cake for fattening cattle. The leaves may be used as fodder either fresh or dry. The flowers are useful in providing honey for bees. By treating the stem of the plant like that of the European flax a very fine fibre, nearly as fine as silk, is produced. Few economic plants, indeed, are more valuable than the sunflower, and it would appear to deserve greater attention for commercial purposes in this part of the Empire.

It is reported that, acting under official advice, special efforts were made this year by the people in Germany to increase the area under sunflower, the produce of small plots being received at collecting depôts for bulking and subsequent treatment.

As to what market there is for sunflower oil, and therefore as to what may be the commercial prospects before it as a crop, there is no data. Doubtless, the linseed oil mills would crush experimental plots and as the seed is an excellent poultry diet, there may be a farmer here or there that would like to grow a plot to discover what the is in it commercially.—*The Farmer*, Western Australia, 5/2/17.

ERADICATION OF BLACKBERRY.

Blackberry vines are a most difficult pest to eradicate. Merely cutting down only tends to strengthen the root growth and ultimately to increase the trouble.

Where the pest is confined to a small area intended for constant cultivation, trenching to a depth of 18 inches to 2 feet and removing all growth to that depth, is the surest way, though perhaps somewhat laborious. Every part, roots, butts and vines, should be burnt.

Another method now being tried by this Department is the caustic soda treatment. This chemical, of a strength of 2 lbs. caustic soda to 4 gallons of water, has the advantage of being non-poisonous, and is best applied as follows:—

First cut the vines down close to the ground, and when dry enough burn them. Then from a watering can, with the rose attached, give the surface from which the vines have been cut a thorough soaking of the above solution. The area is then left until a new growth springs up and has grown to 4 or 5 inches high. It is not necessary to cut this growth down, but it is advised to give it a further soaking of the solution, which will soon kill more of the tops and root, but perhaps still will not kill the lot. This process will need to be repeated, so as to keep the leaf growth in check, for it is only by keeping the tops down that the roots can be ultimately overcome.

A strong brine solution, similar to that used by butchers for salting down meat, applied in a similar fashion to the caustic soda solution, will give the same results, and both these substances have the advantage of being ultimately washed out of the soil by rain, owing to their being so highly soluble in water—a big point in their favour for land that is required for cultivation.

A solution of arsenite of soda acts in a similar way, but owing to its highly poisonous nature, and the danger from children picking the fruit, it is not recommended.

Where the infested area is extensive, and is securely fenced, a flock of sheep or goats kept on it for a few months helps greatly in eradicating this pest.—[*Agricultural Gazette of N. S. Wales*, May, 1917.]

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

Planting.

The time has now arrived when the general planting of deciduous fruit trees will take place. The soil should have previously been well ploughed and subsoiled, and, as far as possible, drained. Certainly to insure satisfactory results, the orchard must be subsoiled. Where expense is a consideration, drainage may be left for subsequent years, but once the orchard has been planted, it will be impossible to subsoil.

When planting out, the distance between the trees will be determined by the kinds to be planted. For ordinary deciduous fruiting trees it is the custom in this State to plant them 20 feet apart in the rows, the rows also being 20 feet apart. Results have proved this to be a satisfactory practice. Almond trees may be planted 15 or 16 feet apart each way, while walnuts, owing to their spreading habit, require a distance of 30 feet apart each way.

Deep planting is not advocated, the general practice being that the depth of planting in the nursery should be followed. If holes are dug, they should be shallow, the bottom being merely loosened to allow a comfortable friable bed for the tree roots. A good practice is to dig the whole strip along which the trees are to be planted, merely removing sufficient soil afterwards when planting. Another satisfactory custom is to plough furrows 20 feet apart, and to plant the trees in the furrows, filling in the soil over the roots and trampling well down.

Before planting, the roots of the young trees should be well trimmed, shaped to an even form, and cleanly cut. As the result of their removal from the nursery beds, the roots are generally more or less damaged, and numbers of the fibrous roots, becoming dry, shrivel and die. These all require a clean trimming. Then it is often desirable to remove some of the roots so as to balance the root system. The trimming of the roots gives the young tree a clean root system, and it is enabled to establish itself with young, vigorous roots.

After planting, the top should be well cut back, so as to leave three or four arms, with three or four buds on each. Where it is not possible

to have this number of arms or limbs it is frequently advisable to cut back to one stem, allowing the buds to break out strongly and frame the tree after planting. In some localities, the custom of not cutting back the trees the first year is favoured. Local experience has not resulted in favour of this practice, as it is found to be inadvisable to unduly strain the young tree by leaving a heavy top to be supported by the weak growing root system.

A number of good commercial fruits have been found to be either wholly or partially self-sterile, requiring other varieties near them to enable them to set their fruit. For this purpose it is necessary that the bloom periods should be somewhat coincident.

SPRAYING.

The dry season has been favorable, in many districts, to the increase of certain scale insects, woolly aphis, and the bryobia mite. The use of red oil has been advocated for these pests, and, as well, crude petroleum, kerosene and other oil emulsions have proved satisfactory. Some years ago the use of lime, sulphur and salt spray was much in vogue as a winter spray. Owing, however, to the difficulty of preparing the spray, and to its caustic effect on the skin, it was practically abandoned as an insecticide. Even then it was claimed, and rightly so, that the spray was, to a certain extent, a very good fungicide. The use of this mixture as a winter wash, with the omission of the salt, which has been found to be an unnecessary ingredient, is now general: and, as it is obtainable in a ready-made form, it is to be strongly recommended as a good all round winter spray.

GENERAL WORK.

All ploughing should now be completed; if not, it should be finished before spraying and pruning operations are proceeded with.

Any autumn manuring or liming should also be now carried out. This, too, should be finished before spraying or pruning. Before spraying with oils or with lime sulphur wash, all rough bark on apple and pear trees should be scraped off. This will mean the certain destruction of any codlin moth larvæ hiding underneath.

The Vegetable Garden.

If not previously done, asparagus beds should be well cleaned out, and a top dressing of manure given. To insure good drainage, the soil from the paths, or between the beds, may be thrown up on the beds, so as to deepen the surface drainage, and to consequently warm the beds. This will mean earlier growths. A heavy dressing of manure should be given, and the beds well and roughly dug over.

Plant out seeds of tomatoes and the pumpkin family in the frames, and sow in the open, seeds of peas, lettuce, spinach, broad beans, radish, onions, carrot and leek. Asparagus crowns, rhubarb roots, tubers of Jerusalem artichokes, shallots and onions may now be planted out. Celery should still be earthed up, taking care not to have the beds too wet.

The Flower Garden.

General cleaning up and digging will be the work for this month in flower section and shubbery. Where the soil is heavy or sour, or where

sorrel is plentiful, the garden should be given a heavy dressing of fresh lime, giving a fair dusting all over the surface. Lime should not be used in conjunction with leaves, garden *débris*, leaf-mould, stable manure, or any other organic matter used for humus. These should be first disposed of by digging well into the soil; then shortly afterwards a top dressing of lime may be given. Should no humic material be used, the lime may be dug in with the autumn digging.

In cleaning up gardens, all light litter and foliage should be either dug in, or, better still, it should be placed in an out-of-the-way corner to form a compost heap. Leaf-mould, well rotted, is especially useful in any garden, and where such plants as Azaleas, Rhododendrons, Liliums, &c., are grown, or for pot plant work it is exceedingly valuable. In forming the compost heap, no medium whatever should be added to help the rotting down of the leaves unless it be a little sand. Any chemical added will render the mould unsuitable for its special objects.

Any hardy annuals may be planted out, such as stocks, pansies, wall-flowers, &c., and cuttings of roses and hardwood shrubs may also be planted. In planting out cuttings it is very important that all the eyes should be removed from the part of the cutting which is to be below the ground. If this be not doue, there will always be the subsequeut danger of the plant suckering.

Roses and any summer and autumn flowering shrubs that have finished flowering may be pruned. If the spring flowering shrubs have not previously been pruned, they should be allowed to remain until after the next flowering season. This especially applies to such plauts as Spireas, Philadelphus (Mock Orange), Deutzia, Prunus Mume, and other early flowering shrubs. To prune these now would mean the certain loss of a great proportion of their flowers.

In pruning, the shrubs may be well thinned out, especially removing any weak upright or old floweriug growths; keep the shrub always at an outward growth, inclining to a broad bushy type, instead of to an upright habit. By this means, the lower regions will always be furnished with good growth. Shrubs and trees of all descriptions should never be allowed to become too crowded; they require to be opened, so as to allow sunlight and air into the interior, where it is most needed. This is one means by which this class of plants may be kept healthy and free from disease. Very few shrubs resent pruning, and the majority of them, including Australian shrubs, such as Acacias, are very amenable to the pruning knife.

In rose pruning, tho rule is that strong growing plants require less severe cutting than the weak growing ones. As roses always flower on new wood, it is essential that to have good blooms the bushes must be pruned regularly. All weak growths, exhausted and worn out wood must be removed, retaining only vigorous growths. It is generally advisable to always prune to four or five eyes or buds, so as to have subsequent strong growths, always pruning into the previous season's wood. Spindly growths, especially in the centres of the bushes, should be removed, the plants being trained with an open and angular habit.

To prevent loss by decay, it will be advisable to lift and store such herbaceous plants as delphiniums, perennial phlox, rudbeckias, &c., also dahlias, tubers, chrysanthemums, cannas, and perennial sunflowers and asters. Failing the possibility of doing this, they should be lifted gently with a fork, so as to allow of a slight air space under the crown.

REMINDERS FOR JULY.

Live Stock.

HORSES.—Those stabled and worked regularly should be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley or linseed. Mares due to foal early if in poor condition should be fed liberally. Commence preparing stallion for season, especially if worked.

CATTLE.—Cows, if not housed, should be rugged. Rugs should be removed and aired in the daytime when the shade temperature reaches 60 degrees. Give a ration of hay or straw, whole or chaffed, to counteract the purging effects of the young grass. Cows about to calve, if over fat, should be put into a paddock in which the feed is not too abundant. Newly calved cows should be fed liberally to stimulate milk flow. Calves should be kept in warm, dry shed.

PIGS.—Supply plenty of bedding in warm, well-ventilated styes. Keep styes clean and dry. Store pigs should be placed in fattening styes. Sows in fine weather should be given a grass run. Young pigs over two months old should be removed from lucerne run.

SHEEP.—Go carefully through all breeding flocks on conclusion of lambing. Reserve all best-framed and profitable-fleeced ewes. Ear mark all found undesirable to breed from, and dispose of any that may be fat before prices recede in the spring. Use a neat mark for ear-marking, not the "slash," "top off," and other oversized unsightly marks. Discard all undersized, narrow-framed ewes, any with short yellow fleeces, those with thin locky staple, any with very fine, light, and wasty fleeces, ewes with "bottle" udders, single teats, undershot, overshot, or otherwise deformed mouths, ewes six years old and over. Draw teeth of aged ewes altogether, if showing open and signs of feed slipping through. Consider well before selling any early born, good-fleeced ewe lambs this coming season. Select best rams for future service; remember, wide, thick sheep are best thrivers, but they must carry good fleeces as well. Keep all ewes well crutched and the udders and eyes well cleared of wool previous to lambing. Give lambing flocks good attention.

POULTRY.—Mating of birds intended for breeding purposes should receive immediate attention. Ten second-season Leghorns or Minorcas, or six of the heavier birds, such as Orpingtons, Plymouth Rocks, and Wyandottes (preferably in their second year), with a vigorous unrelated cockerel will be found satisfactory. Table birds bred in March or April will pay handsomely prior to the Cup Carnival. A tonic in drinking water as a preventive against chicken pox and other ailments is advantageous.

Cultivation.

FARM.—Finish sowing barley, peas and beans, and late white oats in backward districts. Trim hedges. Fallow for potatoes, maize, and other summer crops; in early districts, plant potatoes. Graze off early crops where possible.

ORCHARD.—Continue to plant deciduous fruit trees, bush fruits, and strawberries. Continue cultivating and pruning. Spray for mites, aphides, and scales.

FLOWER GARDEN.—Plant shrubs, climbers, and permanent plants, including roses; also annuals and herbaceous perennials, early Gladioli, Liliums, Iris, and similar plants. Continue digging, manuring, trenching, and liming.

VEGETABLE GARDEN.—Plant out seedlings. Sow seeds of carrots, parsnips, cauliflowers, onions, peas, broad beans, and tomatoes. Dig all vacant plots.

VINEYARD.—Proceed with pruning, burning off, and ploughing. Where Anthracnose (black spot) has been prevalent special care must be taken in burning off to leave no affected twigs on the ground. Complete, as early as possible, the application of manures if not already done. Mark out land for new plantations. If ground is in good order and not too wet, proceed with plantation of young vines (unpruned). Remove cuttings or scions from vines previously marked, and keep fresh by burying horizontally in almost dry sand in cool, sheltered place. Permanently stake or trellis last year's plantations.

Cellars.—Rack all young wines, whether previously racked or not. Rack older wines also. For this work choose, as much as possible, fine weather and high barometer. Fill up regularly all unfortified wines. This is a good time for bottling wine.

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APPLE CULTURE IN VICTORIA.

By J. Farrell, Orchard Supervisor.

(Continued from page 344.)

The Blooming of Apple Trees.

With the genial return of spring and its seasonable, invigorating accompaniments, comes the development and opening of the young leaves of the apple tree. This reveals the delicate tracery of pink which soon expands and envelops the tree in a beautiful floral robe, that for a brief period obscures the developing garment of green foliage. Thus the arrival of spring marks the commencement of the orchardist's year, and the blooming of his trees is regarded by him as the frontispiece of Nature's annual picture book.

This great change in the appearance of the tree as compared with its winter aspect, is brought about by the earth's annual motion. Again Victoria is gradually brought into a favorable position in relation to the sun whence our orchard soils obtain their surface heat which plays such an important part in the growth of the tree, as explained in connexion with osmosis.

When compared with the other States of the Commonwealth, Victoria, partly on account of its latitudinally favorable geographical position and consequent temperate climate, and partly owing to the high horticultural attainments of its fruit-growers, supplemented by their keen industrial efforts generally, is the most successful apple-growing State on the mainland.

The variation in the physical features of Victoria and its many classes of soil also render our State suitable for the cultivation of almost all the other fruits grown commercially in the Commonwealth. As the individual characteristics and needs of these become known they are assigned to localities suitable to their requirements and profitable cultivation.

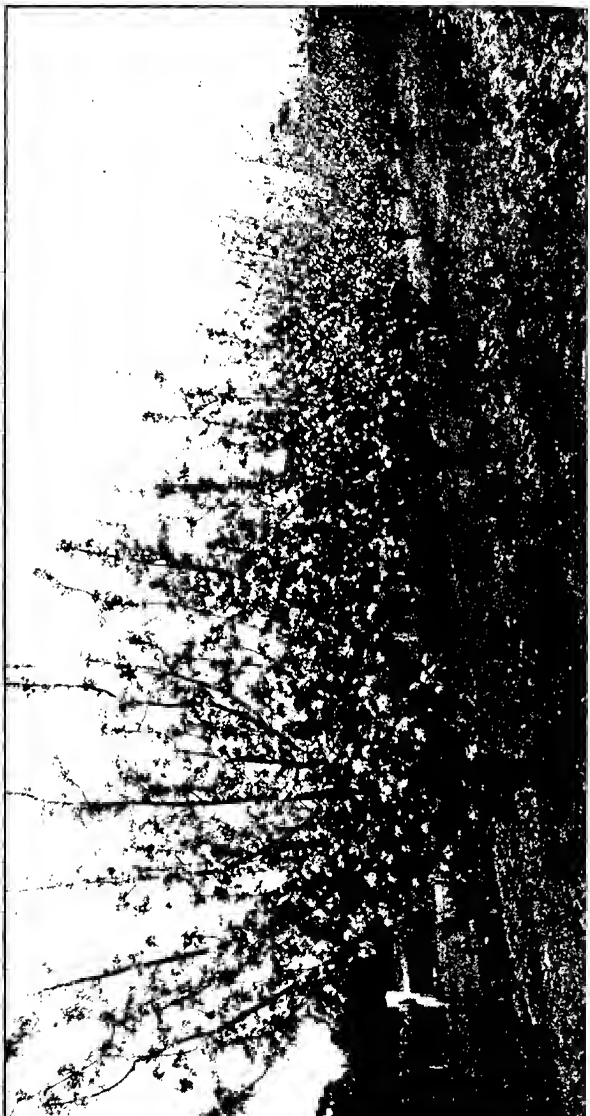


Plate 101.—Row of "Statesman" trees in full bloom.

Structural Formation of the Flower.

When the subject of pruning was being dealt with it was fully explained and abundant illustrations given, showing, under the various conditions, the classes of wood on which the blossoms are produced, so that we may now safely pass on to the structural formation of the flower.

Plate 101 shows a row of shapely Statesman trees in full bloom. The blooming period of the apple tree, normal conditions prevailing, from the time the petals show pink in the blossom until they drop off the tree after fertilization has taken place, occupies about ten days.

The flowers are the reproductive organs of the tree. The apple tree flower usually consists, like those of other pomaceous fruits, of a pistil in five divisions with their stigmas. These pistil divisions form a union of their styles above the nectary through which they pass and develop into an ovary divided into five chambers, each of which contains two ovules or embryonic pips. Twenty stamens stand around the edge of the disk, and in this position their anthers or pollen cases are in close proximity to the stigmas on the points of the pistil divisions. A corolla of five pink or white petals, according to the variety, is supported by the sepals at the point where they form the rim of the disk, when the flower is fully expanded. Then there are on the outside the five small pointed leaves or sepals which form a cup for the flower bud, and which protect the more delicate and vital organs during their earlier stages. When the fruit has attained that condition of development commonly referred to as having "set," through the process of fertilization, and when the sepals are made to close up through the swelling of the fruit, this part is then better known as the calyx of the apple.

Apple blossoms are mostly borne in clusters of florets, generally six in each, and the centre one invariably opens earlier than the others which encircle it. Although as a rule the centre floret is shorter stemmed and stronger than the others, yet, when the tree sets a heavy crop of fruit, this predominant floret is usually subdued.

Plate 102 is a photograph, natural size, of a cluster of Rome Beauty blossoms. The stalks of the individual flowers have commenced to separate from each other, and the sepals of the centre floret have opened exposing the still folded petals.

Fig. 2 depicts six stages of the flower of the London Pippin variety, which was known until recently as Five Crown, its name, like some others, having been changed by the Pomological Committee.

The condition of the florets of the blossom bud, when they commence to stand apart, is represented by specimen (*a*), which, a few days later assumes the formation of (*b*), which, a little later still, becomes plump like (*c*) and shows pink in the petals before they commence to open. When stage (*d*) is reached the protective coverings of sepals and petals begin to open and individually expand. This permits of the gradual development of the stamens and pistils which are the male and female organs respectively. In (*e*) it will be observed that the sunlight has commenced to act upon the central organs, which soon become strengthened, as shown in (*f*).

Plate 103 gives four phases of the flower of the Granny Smith variety. These illustrate the different conditions and positions of the stamens and pistil in relation to each other during the later stages of

Plate 102.—Fig. 1.—A cluster of Rome Beauty blossoms (natural size). Fig. 2.—Six stages of London Pippin blossoms (natural size).

their existence. Owing to the pressure exerted by the sepals and petals, as shown in (*a*), upon the central organs, the latter have to retain their somewhat contorted forms until they are liberated like (*b*).

At this stago the stigmas begin to assume their receptive condition as the pollen ripens in the anthers, and the process of fertilization takes place while the male and female organs are in the condition shown in (*c*). When this stage has passed the petals fall off and the flower assumes the appearance of (*d*).

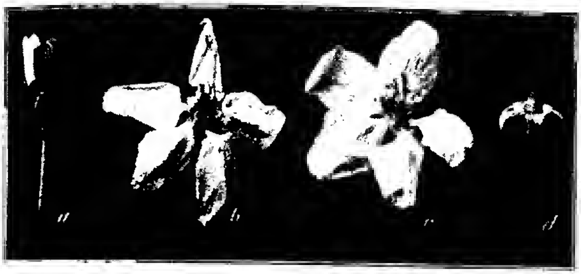


Plate 103.—Four of the last stages of the flower of the Granny Smith variety. (Natural size.)

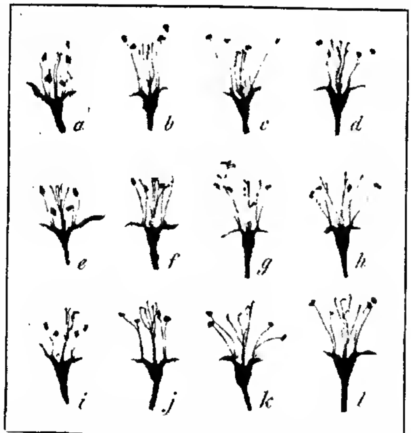


Plate 104.—Sections of the flowers of the Jonathan, London Pippin and Rome Beauty, showing the relative position, &c., of the stamens to the pistils. (Natural size.)

Plate 104 gives four vertical sections each of the flowers of the Jonathan, London Pippin, and Rome Beauty varieties respectively. When mounting these specimens to be photographed the writer removed the petals from the first three specimens of each kind, and portions of the sepals of the four as shown. The pistils were retained with two stamens on each side. Specimens (*a*), (*b*), (*c*), (*d*) are from a Jonathan tree, and they corresponded, prior to being mounted, with

those similarly lettered in Plate 103. Figures (*e*), (*f*), (*g*), (*h*), and (*i*), (*j*), (*k*), (*l*) are London Pippin and Rome Beauty flowers respectively, showing correspondingly similar conditions of the vital organs of the blooms of these varieties.

Plate 105 shows two decentralized flowers; Fig. 1 is Jonathan and Fig. 2 is Bellflower. In mounting these specimens to be photographed

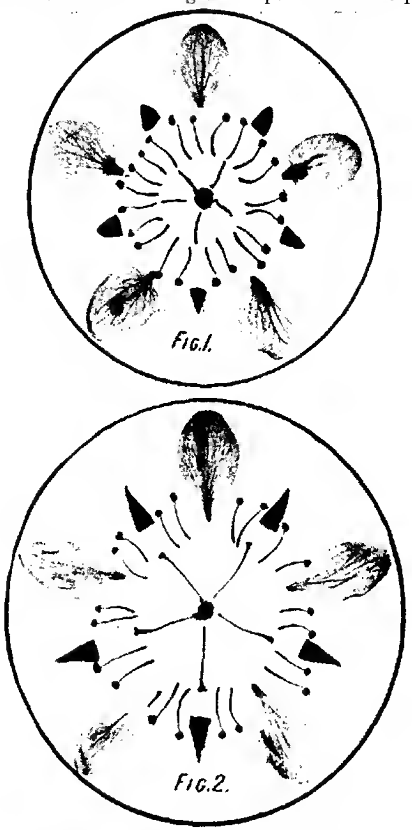


Plate 105.—Decentralized Flowers.
Fig. 1—Of the Jonathan. Fig. 2.—of the Bellflower. (5-6ths natural size.)

the writer was careful when decentralizing the various organs to see that they should occupy positions as relatively near each other as they did when the flowers were intact.

In order to arrange the organs of the flowers as shown, cross sections of the ovaries were first made and placed in the centre. Then

the five pistil divisions, twenty stamens, five sepals, and five petals were removed from the flowers and arranged as they appear in the illustrations.

To acquire a thorough practical as well as the ordinary theoretical knowledge of the botanical construction of the apple tree flower it is essential that every earnest student of horticulture should dismember and decentralize the flowers in this manner.

Plate 106 shows the petals of the flower of a Gravenstein tree. These organs of the flowers of the several varieties, like their leaves, vary in size according to the class of soil and other conditions under which the trees are grown. This characteristic is more noticeable in the Gravenstein, however, than in any other variety. The specimens in this plate, like those in Plate 105, are five-sixths natural size.

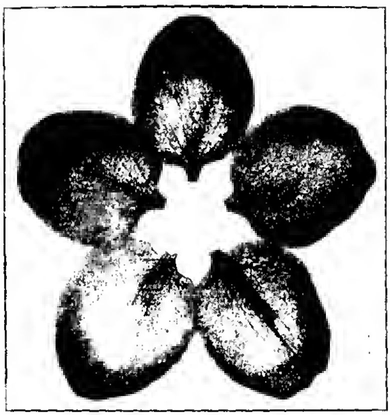


Plate 106.—Large Petals of the Gravenstein. (5-6ths natural size.)

A natural-size photograph of a section of an apple blossom, or even an enlargement of same, in which its parts may be lettered in the usual way as a guide to beginners in the study of the botanical construction of the flower, is rarely as distinct as a drawing. Consequently, the diagram of the longitudinal section in Plate 107 gives a more lucid illustration of the various parts which constitute the flower.

Not alone should this diagram be consulted in connexion with past references made to the organs of the flower, but it may also be taken in part to illustrate future statements which will have reference mostly to pollination, fertilization, and nomenclature.

A flower is said to be perfect when it contains all its organs and is normally developed, conditions which almost invariably characterize apple blossoms.

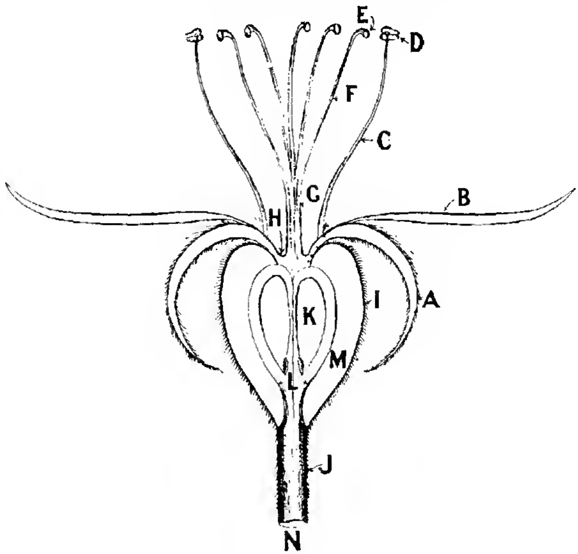


Plate 107.—Diagram of Longitdinal Section of the Flower (Enlarged).

A—The Sepal.
B—The Petal.
C—The Stamen.
D—The Anther.
E—The Stigma.
F—The Style.
G—Union of the Pistil divisions.
H—The Nectary.
I—The Rind.
J—The Stem.
K—The Ovule.
L—The Ovary.
M—The Fleshy Part.
N—Point of union with the Parent Twig.

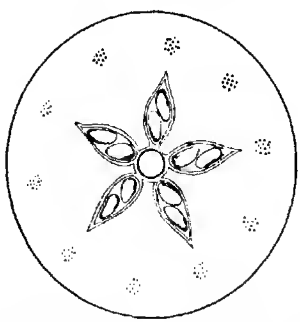


Plate 108.—Enlarged cross section of a young fruit, showing the ovary, ovules, and vascular bundles.

A staminate flower has stamens but no pistil, while one of the pistilliferous character has a pistil without stamens. While carrying out observations and collecting data in this regard, the writer was unable to discover an apple tree producing flowers of the former character, while one producing those of the latter was found, photographic illustrations of which will be given later on. Mr. E. Wallis, Orchard Supervisor, has found in the Bacchus Marsh district an apple tree which was sterile in consequence of its producing staminate flowers.

Pollination and Fertilization.

When the sepals and petals, in turn, expand they liberate the male and female organs, which, favorable weather ensuing, soon arrive at the stage of pollination. The pollen, a single grain of which is almost microscopic, but when in clusters may be easily seen by the naked eye, quickly ripens in the anthers, which then burst and liberate it. During this period, in the case of self-pollination, the stigma assumes the condition of receptivity which is indicated by the appearance of a little sticky fluid oozing from it.

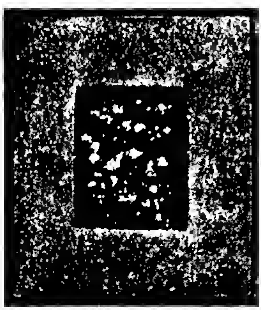
A pollen grain lodges on this fluid in the mouth of the stigma, it then absorbs the moisture, and sends out, or rather elongates into, a tube, which passes down through the centre of the pistil division to the ovary (L), the walls of which are indicated by the arrows. The tube reaches its destination on entering the micropyle, or opening in the ovule, and then acts as a channel through which the protoplasm or living and life-giving fluid is conveyed from the pollen grain to the ovule, which it fertilizes.

After fertilization has taken place the young fruit commences to swell, and establishes its connexion with the tree through calling on it for support. But blossoms which fail to set fruit, from whatever cause, soon lose their vitality and part company with the tree at the base of the flower stalk, the point (N).

Through systematic winter pruning a reasonable quantity of blossom buds of good quality may be maintained on the trees, and usually when from 10 to 20 per cent. of the flowers produce fruit, other conditions being favorable, a good crop may be anticipated. However, trees, which are allowed to exhaust themselves by producing abnormally heavy crops of blossoms through want of scientific pruning, may set as many, but inferior fruits, on from 3 to 5 per cent. of their blooms.

Plate 108 is a diagram showing an enlarged cross section through the ovary of a young fruit. In its normal condition, as shown, the ovary consists of five chambers, the carpels or walls of which are composed of a comparatively strong, tough, membraneous substance. But when the pistil divisions deviate from the normal by showing an increase or a decrease in their number, the ovary chambers vary in number correspondingly. Photographic illustrations showing ovaries divided into four and three chambers respectively with corresponding pistil divisions, will be given later. Prior to and during the period of fertilization the ovules stand in pairs in the ends of the chambers next the centre and are so conveniently placed that the pollen tubes are easily brought into contact with them. The relative positions, in

which the cross sections of the ovules are shown in the illustration, however, represent those they occupy when fertilization is completed and when they have commenced to develop. The ten clusters of black dots represent the positions of the vascular bundles, which, as the apple develops, branch into fibro-vascular strands through the fleshy part, bracing the apple together and acting as food channels as well.



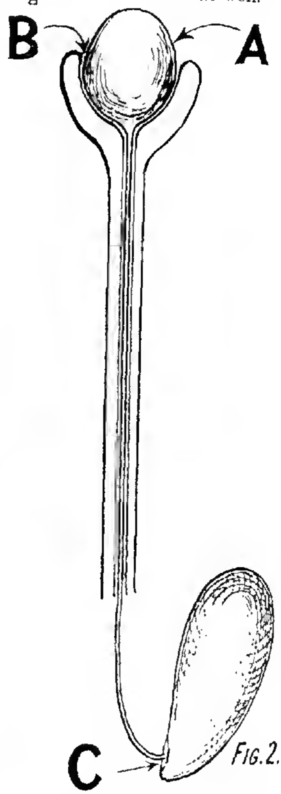


Plate 109.

Fig. 1.—Showing clusters of pollen grains (natural size).

Fig. 2.—Showing action of pollen grain during the process of fertilization (highly enlarged).

When the pollen grains, before they commence to ripen, are removed from the anther, they present a rather plump appearance, and are of a silvery white colour. As the process of their ripening advances, however, the pollen turns yellow, and later often becomes dark or reddish brown.

Plate 109, Fig. 1, is a photograph of clusters of Jonathan pollen grains, which appear white on the black back-ground. Fig. 2 is a drawing of a highly-enlarged vertical section of a pistil division depicting the pollen grain (A) in the jaws of the stigma. The position of the sticky fluid, which oozes from the stigma prior to the time of pollination, and which is absorbed by the pollen grain during the period of its germination, is indicated by (B), while (C) shows the pollen tube, after passing down the pistil, entering the micropyle in the ovule. Through this tube the life-giving protoplasm passes from the pollen grain to the ovule, which, by infusion, it fertilizes.

Sterility In Apple Trees.

While the admirer of nature's floral decorations is in a state of ecstasy when he beholds an apple orchard in bloom diluting the air with a delicate, pleasing perfume, and adorning the district in which it is situated, its owner is experiencing a most anxious time.

Although the enterprising and industrious orchardist brings about these pleasing surroundings, he is unable to fully appreciate, in this respect, the result of his labours, because the success or failure of his fruit crop for the year largely depends on the ways of nature during this critical period. The anxiety is considerably alleviated, however, when the orchardist commences and continues to work his trees on scientific lines. In this connexion the careful selection of buds from which to propagate the trees and prevent variety degeneration, the choosing of suitable soil and favorable locality conditions, the insuring of interpollination of sterile or partly sterile varieties by interplanting with others suitable for this purpose, and the maintenance of a few hives of bees in a cosy corner of the orchard, are details, which, of recent times have become ethics in modern horticultural science.

The officers of the Orchard Supervision Branch have for many years advocated the practice of these essential details, with such a hearty response on the part of the fruit-growers, that at the present time it is difficult to find a young orchard being established in which these remedial measures against sterility are not being employed.

Sterility in certain varieties of apple trees has become more apparent during late years than it was formerly, and the supervisors had frequently to explain the cause of this. The old apple orchard contained many varieties, and thus interpollination, in this respect, was unconsciously provided for. But the modern orchard is planted with only a few selected varieties, which may not bloom simultaneously, and it is essential, in order to cross pollinate successfully, that the stigmas of the sterile variety should be in the receptive condition when the pollen of the fertilizer is ripe.

The chief causes of sterility and "shy" bearing may be summarized as follows:—

1. Some trees do not blossom freely, and rarely bear fruit, owing to variety degeneration, caused mainly by the propagator having failed to carefully select the buds from which the trees were grown.

2. The neglect of scientific pruning and the consequent production of an unnecessarily large quantity of blossom, through which

the stamens and pistils are weakened, the pollen partly impotent, and the trees' vitality impaired during the blooming period.

3. The natural weakness or imperfection of the structural formation of the flowers or impotency of the pollen.

4. The insufficiency of fluid in the stigmas to insure the germination of the pollen grains and to facilitate the elongation of the pollen tubes.

5. The stigmas assuming the receptive condition before the pollen is ripe, or *vice versâ.*

6. The planting of varieties on unsuitable soils or under unfavorable climatic conditions.

7. The neglect of inter-planting sterile sorts with varieties suitable for interpollination.

8. The want of bees, in or near the orchard, as a cross-pollinating agency by which cross-fertilization is greatly facilitated.

That Nature, in animal life, abhors inbreeding is reflected in the weak bodily condition and general imperfect constitution of the specimens resulting from a too close blood relationship of the parents forming the union. The law which governs animal reproduction, in this respect, is also applicable in a marked degree to the fertilization of the blossoms of fruit trees, and, to some extent, in plant life generally.

The stigmas, in obedience to this law, mostly repel, or endeavour to repel, the pollen from their own flowers, and even that from the flowers of a different tree of the same variety.

Cross-fertilized flowers invariably set a heavier crop of better-shaped fruits, which contain larger numbers of fully-developed seeds, than those self-fertilized.

Continual heavy rains, accompanied by comparatively low temperatures and intermittent frosts during the blooming, practically prevent the setting of all varieties; but these conditions, even in localities which favour them, are rare. Dry, hot winds, on the other hand, reduce the quantity of fluid in the stigmas and encourage the development of Thrip (*Thrips tabaci*), which often destroy the reproductive organs of late-blooming varieties and prevent their setting. Medium temperatures with occasional light showers, afford ideal conditions during the blooming period.

Generally speaking, of the early-blooming sorts, the Jonathan, particularly when cultivated under the conditions which produce rank growth, is one of the most noticeable of those which comply freely with Nature's law relating to reproduction by retaining its self-sterility. It has been found, however, that when grown on the lighter, well-cultivated and manured, sweet, Siluran soils, this variety often liberally meets the orchardist's requirements by producing heavy crops of fruit without the aid of a cross-fertilizer. Consequently, when dealing with this subject, it is advisable to generalize rather than to dogmatize. However, as it is known that cross-fertilization increases the quantity and improves the quality of the fruit, it is advisable on every occasion to interplant even to meet the contingency of possible self-sterility. It is obvious that, when planting cross-fertilizers, varieties of high commercial value should be selected in preference to those of inferior quality.

When planting an orchard of Jonathan on rich, well-drained soil, the Yates may be used to interplant, as these conditions favour its cultivation; but when the soil is below the average fertility, and particularly if undrained, Gravenstein, Delicious, or Sturmer may be employed. Commencing on the outside with two rows of Yates or other variety chosen to inter-pollinate, then four rows of Jonathan, two rows of Yates, and so on until the planting of the block is completed. One row of Yates or other variety employed for the same purpose would be sufficient to secure the desired effect, but, in connexion with spraying and general management of the orchard, it has been found desirable to employ two rows successively.

Insufficiency of fluid in the stigmas has been given as one of the probable causes of sterility. This defect is most noticeable in the Jonathan, which invariably shows under-development of the stigmas, and this may be observed in the decentralized flower in Plate 105, Fig. 1, as compared with the higher development of the stigmas of the Bellflower, Fig. 2. As a rule, the larger the stigma, the more fluid it contains. Illustrations of 216 varieties of stigmas will be given later in connexion with nomenclature of the apple.

The late-blooming varieties, London Pippin, Rome Beauty, &c., are often sterile if not inter-planted, but an orchard containing a mixture of these, other conditions being favorable, is usually most fruitful.

The Part the Bee plays in Fruit Production.

In order to fertilize a flower so that it may set fruit, it is necessary that a pollen grain should lodge and germinate in the stigma. In the case of self-pollination, the pollen may be carried from the

Plate 110.—Bees in the Orchard.

anthers to the stigmas by wind or by the various insects which inhabit the flowers during the blossoming period.

When shy-bearing varieties are inter-planted with others whose pollen is known to fertilize the flowers of the former, bees are the best agency by which to secure inter-pollination. For this purpose the orchardist should keep a few hives of bees in a sheltered, warm corner of the orchard, preferably, facing the north or north-east, so that, during early spring, the morning sun may shine on the hives. The orchardist soon learns the economic management the bees require, and when he realizes what incalculable assistance they render him in the orchard, as well as the honey they return, he soon commences to

Plate 111.—The Bee in the Blossom.

beautify the surroundings of the little apiary, and thus provides congenial environments under which the bees work to greater advantage.

The bees should be given every facility to operate freely and under healthy conditions, therefore, the trees should never be sprayed while in bloom. Nor is there any occasion to use spray mixture during this

period. The Bordeaux Mixture, or other spray for Black Spot, should be used about four days before the petals open, and the first spray for Codlin Moth should not be applied until after the petals have fallen.

Plate 110 shows an orchard apiary, with the trees in full bloom, and it is reproduced from an illustration given by Mr. F. R. Beuhne in his article on bees in the *Journal of Agriculture* for May, 1914. It is not desirable in a commercial orchard to have the hives amongst the trees, as they should be out of the way for cultivation, spraying, &c., and as the bees are capable of travelling a considerable distance in search of nectar, they may be housed in almost any corner of the orchard.

Plate 111 depicts a bee in a London Pippin flower. It will be observed that the stamens at the anther ends fit rather closely around the styles, and that the bee has some difficulty in reaching the nectary with its proboscis to collect the nectar.

Assume that this is the variety which requires inter-pollination, and that the bee, with pollen attached to its body, has come from the tree which was planted to cross-pollinate it. Then it will be understood how the foreign pollen grains on the body of the bee are introduced into the stigmas as the insect, in search of the nectar below, endeavours to force the stamens apart.

The dates on which the different varieties are in full bloom each year vary from seven to ten days, according to the weather conditions prevailing at the time.

The following is a list of 226 varieties of apples growing in Victoria and their dates of full bloom, which has been compiled by the orchard supervisors in the various districts as shown:—

DATES OF BLOOMING.

Variety.	Districts.						
	Bendigo.	Diamond Creek.	Doncaster.	Evelyn.	Goulburn Valley and North-East.	Maryborough.	Western.
Adam's Pearmain ..	28–10	..	..	12–10	31–10	22–10	..
Akero	..	..	..	1–10	..	..	..
Albury Park Nonsuch ..	..	..	..	20–10	..	..	..
Alfriston	..	..	..	10–10	..	..	..
Allington Pippin ..	..	..	..	10–10	..	..	..
Allsopp's Beauty ..	..	..	..	16–10	..	..	..
Amassia	..	..	..	2–10	..	..	..
American Golden Russet ..	..	..	..	4–10	..	..	..
Anna Elizabeth	28–10	6–11	5–11	10–10	26–10	20–10	..
Autumn Pearmain ..	..	..	..	13–10	..	..	15–10
Ballarat Seedling.. ..	..	..	..	15–10	..	..	..
Baldwin	..	..	..	3–10	..	..	..
Barry	..	..	..	20–10	..	..	..
Beauty of Bath	..	..	..	16–10	..	..	..
Belle de Pontoise ..	..	..	..	20–10	..	..	..
Ben Davis	4–10	..	..	25–10	..	..	20–10
Black Ben Davis ..	..	..	..	5–10	..	..	..
Blenheim Orange ..	..	..	..	8–10	..	..	..
Blondin	..	..	..	18–10	..	..	..

Dates of Blooming—*continued.*

Variety.	Districts.						
	Bendigo.	Diamond Creek.	Doncaster.	Evelyn.	Goulburn Valley and North-East.	Maryborough.	Western.
Boston Russet	..	..	..	15–10	..	..	..
Baumann's Red Winter Reinette	..	..	..	3–10	..	..	..
Broadleaved Norman	..	..	..	12–10	..	..	..
Buncombe	28–10	30–10	..	18–10	..	20–10	31–10
Cardinal	..	..	..	15–10	..	..	..
Carolina Red June	..	..	..	11–10	..	..	..
Cat's Head	18–10	..	..	..	..	..	..
Calville Blanche D'Hiver	..	..	..	8–10	..	..	..
Cellini	..	23–10	..	15–10	..	..	..
Champion	..	..	..	20–10	..	..	..
Cheltenham Pippin	..	..	..	12–10	..	..	..
Chicago	..	..	..	26–10	..	..	..
Clygate Pearmain	..	..	..	4–10	..	..	..
Clayton	..	..	..	..	10–10	..	..
Cleopatra	18–10	..	..	17–10	6–10	12–10	17–10
Climax	..	..	..	4–10	..	..	..
Coldstream Guard	..	..	..	1–10	..	..	..
Cole's Rymer	..	..	..	10–10	..	..	..
Commerce	..	..	..	12–10	..	..	22–10
Coral	..	..	..	16–10	..	..	..
Cox's Orange Pippin	12–10	17–10	..	12–10	..	6–10	..
Cowarne Red	..	..	..	2–10	..	..	..
Craike's Seedling	18–10	..	..	..	..	..	..
Crisp's Russet	..	..	..	10–10	..	..	..
Crofton Pearmain	..	..	..	7–10	..	..	..
Crow's Egg	..	..	..	5–10	..	..	..
D'Arcy's Spice	..	..	..	8–10	..	..	..
Dartmouth	..	..	..	18–10	..	..	..
Delicious	18–10	..	..	13–10	..	..	..
Devonshire Quarrenden	18–10	..	6–10	12–10	..	..	19–10
Doctor Hogg	..	..	..	17–10	17–10	..	..
Dougherty	..	19–10	18–10	20–10	..	..	..
Draper's Best	18–10	..	..	..	..	..	..
Duchess of Oldenburg	..	8–10	4–10	4–10	9–10	..	..
Dumelow's Seedling	4–10	18–10	..	18–10	10–10	6–10	..
Dunn's Seedling	..	..	..	12–10	..	..	..
Early Margaret	..	22–10	..	9–10	..	..	..
Early Richmond	..	..	..	18–10	..	..	..
Early Strawberry	18–10	..	..	..	..	..	..
Early Rivers	..	..	..	6–10	..	..	..
Ecklinville	..	..	..	..	..	..	17–10
Emperor Alexander	4–10	22–10	17–10	18–10	..	..	..
Emperor Alexander White	..	..	..	18–10	..	..	..
England's Glory	..	..	..	7–10	..	..	..
Esopus Spitzenberg	4–10	21–10	19–10	16–10	..	22–10	20–10
Fall Beauty	..	..	..	20–10	..	..	..
Fillbasket	..	..	..	13–10	..	..	..
Foster	..	..	..	12–10	..	..	..
Framboise D'Holovous	..	..	..	3–10	..	..	..
Frampton	..	..	..	15–10	..	..	..
Froth's Gippslander	..	..	..	4–10	..	..	..
French Crab	18–10	..	..	12–10	..	..	1–10
French Paradise	..	..	..	1–10	..	..	..

DATES OF BLOOMING—*continued.*

Variety.	Districts.						
	Bendigo.	Diamond Creek.	Doncaster.	Evelyn.	Goulburn Valley and North-East.	Maryborough.	Western.
Garibaldi	4–10	..	..	..	..	..	..
Garibaldi (Adelaide) ..	..	..	..	2–10	..	..	..
Gascoigne Scarlet ..	..	..	..	23–10	..	..	..
General Carrington ..	..	..	..	24–10	..	..	..
Gladstone	..	12–10	16–10	16–10	..	..	..
Gloria Mundi	..	..	..	20–10	..	..	..
Glowing Coal	..	..	..	5–10	..	..	..
Golden Ball	..	..	..	10–10	..	..	..
Golden Harvey	..	..	..	2–10	..	..	..
Golden Pearmain ..	..	..	..	15–10	..	..	..
Golden Reinette ..	..	..	..	4–10	..	..	..
Golden Russet	..	..	..	15–10	..	..	..
Golden Spire	..	..	..	1–10	..	..	..
Gooseberry Pippin ..	18–10	..	..	15–10	..	..	16–10
Grand Duke Constantine ..	..	..	..	18–10	..	..	..
Grand Sultan	..	..	..	22–10	..	..	..
Granny Smith	..	..	..	19–10	..	..	20–10
Gravenstein	11–10	16–10	13–10	14–10	12–10	..	..
Gravenstein Rouge ..	..	..	..	15–10	..	..	..
Green Alfriston	..	15–10	..	10–10	..	..	..
Hall Door	..	..	..	10–10	..	..	..
Hamilton	..	..	..	..	..	..	9–10
Hoary Morning	12–10	..	18–10	20–10	..	22–10	25–10
Hoover	28–10	5–10	24–10	20–10	..	..	5–11
Horn	..	..	..	..	..	..	5–11
Irish Peach	4–10	11–10	..	14–0	11–10	6–10	8–10
Ivanhoe	..	..	..	5–10	..	..	..
James Grieve	..	..	..	20–10	..	..	..
John Sharp	..	..	..	8–10	..	..	..
John Toon	..	..	..	8–10	..	..	..
Jonathan	18–10	18–10	16–10	17–10	10–10	..	18–10
Jubilee	..	..	..	3–10	..	..	..
Jupp's Surprise	..	..	..	20–10	..	..	..
Kentish Fillbasket ..	4–10	..	..	5–10	..	..	15–10
Kentucky Redstreak ..	4–10	..	..	4–10	12–10	..	..
Keswick Codlin	..	..	..	3–10	..	..	..
King David	..	..	..	13–10	..	..	..
King of Pippins	..	..	..	15–10	..	..	..
King of Tomkin's County ..	..	..	..	4–10	..	..	..
Kingston Black	..	..	..	30–10	..	..	..
Kirk's Admirable ..	..	..	..	12–10	..	..	..
Kooroochiang	..	..	..	24–10	..	..	..
Lady Carrington ..	..	..	..	18–10	..	..	..
Lady Henniker	..	..	..	6–10	..	..	..
Lady Hopetoun	..	..	..	13–10	..	..	..
Late Gravenstein ..	..	..	..	10–10	..	..	..
Late Wine	..	21–10	..	15–10	..	..	..
Lever	..	20–10	..	..	..	..	18–10
Lincolnshire Triumph ..	..	..	..	7–10	..	..	..
Liveland Raspberry ..	..	..	..	2–10	..	..	..
Linwood's Everlasting ..	..	..	..	24–10	..	..	..
London Pippin	28–10	3–11	1–11	27–10	31–10	20–10	7–11
Lord Lennox	..	..	..	14–10	..	..	..
Lord Nelson	..	..	..	7–10	..	..	..

DATES OF BLOOMING—*continued*.

Variety.	Districts.						
	Bendigo.	Diamond Creek.	Doncaster.	Evelyn.	Goulburn Valley and North-East.	Maryborough.	Western.
Lord Suffield	4–10	20–10	15–10	13–10	..	..	..
Lord Wolseley	28–10	22–10	..	25–10	..	..	..
Loy	..	..	..	20–10	..	..	..
Luscombe's Seedling	..	..	..	24–10	..	..	..
Magg's Seedling	..	..	..	11–10	..	..	..
Maiden's Blush	..	..	..	10–10	17–10	..	..
Malus Communis Aurea	..	..	..	1–10	..	..	..
Malus Floribunda	..	..	..	10–10	..	..	..
Margil	..	..	..	10–10	..	..	..
Macindoe's Russet	..	..	..	7–10	..	..	..
McIntosh Red	..	..	..	7–10	..	..	..
McMahon's White	..	..	..	1–10	..	..	..
Mellon's Seedling	18–10	..	..	10–10	..	12–10	31–10
Merritt's Royal Pearmain	18–10	..	..	..	..	..	..
Missouri Pippin	..	22–10	..	15–10	..	..	..
Mona Hay	..	..	..	1–10	..	..	..
Moore's Extra	..	..	..	..	16–10	..	..
Morgan's Seedling	25–10	..	..	5–10	..	..	..
Moss' Incomparable	..	24–10	..	16–10	..	..	..
Munroe's Favorite	4–10	10–10	13–10	8–10	11–10	6–10	11–10
Newman's Seedling	..	..	..	10–10	..	..	..
Newtown Pippin	18–10	..	..	10–10	..	..	13–10
Nickajack	28–10	26–10	..	12–10	..	20–10	..
Northern Spy	26–10	23–10	..	18–10	19–10	..	1–11
Orator	..	..	..	12–10	..	..	..
Oregon Mammoth Black Twig	..	..	..	3–10	..	..	..
Paradise	..	..	..	20–10	..	..	..
Paragon	..	..	..	5–10	..	..	..
Parlin's Beauty	..	..	..	10–10	..	..	..
Peasgood's Nonsuch	..	20–10	..	25–10	..	..	..
Perfection	..	..	..	1–10	..	..	..
Pioneer	..	..	..	12–10	..	..	..
Pomme de Neige	24–10	12–10	12–10	16–10	12–10	12–10	..
Prince Albert	..	..	..	12–10	..	..	..
Prince Alfred	18–10	..	..	7–10	..	..	..
Prince Bismark	4–10	15–10	..	14–10	..	6–10	15–10
Prince Edward	..	..	..	23–10	..	..	..
Prince of Pippins	4–10	5–10	..	8–10	..	6–10	..
Prizetaker	..	..	..	21–10	..	..	..
Rambourg de Winnitza	..	..	..	7–10	..	..	..
Red Astrachan	18–10	..	..	12–10	..	..	8–10
Red Beitzheimer	..	..	..	15–10	..	..	..
Red Cluster	4–10	..	..	12–10	..	..	..
Red Hawthorn	..	..	..	5–10	..	..	..
Red Majestic	..	..	..	16–10	..	..	..
Red Streak	..	..	..	23–10	..	..	..
Rein Louis d'Danemark	..	..	..	20–10	..	..	..
Reinette du Canada	18–10	21–10	18–10	1–10	22–10	12–10	18–10
Rhode Island Greening	..	..	..	1–10	..	..	..
Ribston Pippin	4–10	..	12–10	14–10	..	..	9–10
Rokewood	15–10	20–10	25–10	16–10	..	12–10	20–10
Rome Beauty	28–10	5–11	3–11	27–10	3–11	..	7–11
Royal Late Cooking	..	..	..	4–10	..	..	..

DATES OF BLOOMING—*continued.*

Variety.	Districts.						
	Bendigo.	Diamond Creek.	Doncaster.	Evelyn.	Goulburn Valley and North East.	Maryborough.	Western.
Ruby Pearmain	..	..	..	8-10	..	..	..
Rymer	18-10	21-10	20-10	21-10	18-10	12-10	26-10
Sam Young	..	..	..	22-10	..	..	..
Santa Clara King	..	..	..	22-10	..	..	..
Scarlet Nonpareil	10-10	..	..	4-10	12-10	12-10	20-10
Scarlet Pearmain	..	..	..	18-10	..	..	..
Schroeder's Seedling	18-10	..	..	13-10	..	..	..
Scotch Red Streak	..	..	..	4-10	..	..	..
Senator	..	..	..	16-10	..	..	..
Sharp's Early	..	..	..	2-10	..	..	..
Sharp's Late Red	..	..	..	14-10	..	..	..
Sharp's Nonsuch	..	..	..	24-10	..	..	..
Shepherd's Perfection	13-10	..	..	8-10	10-10	12-10	..
Shockley	18-10	..	..	13-10	15-10	..	20-10
Shoreland Queen	..	..	6-10	10-10	..	..	..
Skyrme's Kernel	..	..	..	23-10	..	..	..
Smith's Early Red	..	..	..	4-10	..	..	..
Smith's Seedling	..	..	6-10	12-10	..	..	..
Stansill	18-10	..	..	20-10	16-10	..	18-10
Statesman	..	..	22-10	22-10	..	..	..
Stayman Winesap	..	..	..	24-10	..	..	..
Stewart's Seedling	..	..	..	15-10	..	12-10	..
Stone Pippin	18-10	21-10	18-10	22-10	20-10	..	22-10
St. Martin	..	..	..	10-10	..	..	..
Sturmer Pippin	13-10	19-10	..	19-10	16-10	12-10	24-10
Summer King	..	..	..	20-10	..	..	..
Swaar	..	..	..	5-10	..	..	..
Taupaki	..	..	..	5-10	..	..	..
Taunton	..	..	..	22-10	..	..	..
The Queen	..	..	..	10-10	..	..	..
Thomas Rivers	..	..	..	5-10	..	..	..
Thompson's Long Keeper	..	..	..	5-10	..	..	..
Trivett's Seedling	..	..	..	1-10	..	..	..
Twenty Ounce	..	..	..	13-10	..	..	..
Unnamed R. B. Seedling	..	..	..	8-10	..	..	..
Wagner	..	..	..	7-10	..	..	..
Waverley	..	..	..	25-10	..	..	..
Wellington	..	..	..	15-10	..	..	..
White's Nonpareil	..	..	..	8-10	..	..	..
Williams Favorite	..	21-10	23-10	22-10	..	..	..
William Anderson	..	..	..	20-10	..	..	..
Winesap	..	..	..	..	24-10	..	..
Wining's Late Red	..	..	..	18-10	..	..	..
Winter Majetin	28-10	28-10	30-10	25-10	17-10	..	2-11
Wolf River	..	..	..	5-10	..	..	..
Worcester Pearmain	..	..	..	25-10	..	..	..
Yates	12-10	15-10	12-10	14-10	17-10	12-10	..

The above list, together with the dates of full bloom, also shows the varieties which are most popular in the various districts. This information may be found of interest to prospective settlers having in view the establishment of apple orchards.

(To be continued.)

ANTHRACNOSE OR BLACK SPOT OF THE VINE

(*Manginia ampelina*, V. and P.).

By F. de Castella, Government Viticulturist, and C. C. Brittlebank, Government Pathologist.

After an almost complete absence from Victorian vineyards extending over some twenty years, Black Spot has re-appeared and, in some localities, at least, in an unusually virulent form. Our long immunity has led growers, especially those whose experience of the vine dates back less than twenty years, to view the recent outbreak with considerable alarm; yet there is really no cause for such.

In the first place the disease is quite amenable to treatment, especially preventive; and, in the second, the pest is not by any means a new one. In Europe it has been known since ancient times, whilst in Victoria, both in Rutherglen and Mildura, our two chief vine districts, older vinegrowers remember it only too well. In the latter district many of the first planted Sultana blocks suffered severely—the cuttings of this variety, which is very liable to the disease, having come from cooler districts where it was prevalent. The winter "swab" on which we must once again fall back, was well known to Mildura growers in the nineties.

Has our climate changed? Meteorologists say not; but we seem to have entered on a cycle of moist, rainy springs, favorable to the disease, which, together with the absence of steps to combat it, have permitted it to obtain a firm hold.

As regards the future: Given a return to normal spring weather, unfavorable to its spread, the disease will no doubt revert to the unimportant position it has so long occupied. But if we fail to get a dry spring, and if no preventive steps are taken, grave damage is not only probable, but certain. A repetition of last year's weather might easily lead, in the absence of treatment, to a real disaster to growers of Sultanas and other susceptible varieties, owing to the abundance of the fungus in its hibernating or resting stages, in which it awaits the return of spring to renew its activity.

It is hoped that the gravity of the situation will be generally recognised, and that the standard preventive treatment about to be described and concerning the efficacy of which there is no room for doubt, will become general in all vineyards where any signs of Anthracnose were noticed last spring and summer.

CONDITIONS FAVORABLE TO THE DISEASE.

Like most fungi, moisture and heat are essential, but Black Spot seems to be able to develop at a lower temperature than many other fungus pests. Locality thus plays an important part; vines on low-lying ground are particularly susceptible. The varying intensity of the disease in different parts of a vineyard is often marked; serious damage may be done in a moist corner liable to fogs and heavy dews, whilst higher, better drained and better aerated portions may escape altogether. The susceptibility of moist spots can often be lessened by drainage.

Sandy soils, notwithstanding their good drainage, seem conducive to the spread of Anthracnose; this was particularly noticeable at Mildura

last season, where vineyards on sandy soils suffered most, no doubt for the reason that such soils long retain a damp surface, thus maintaining a higher degree of moisture in the supernatent air than stiffer soil on which a dry crust soon forms. In wet autumns grapes on sandy soils are in similar manner more liable to suffer from mould, for their vegetation is more luxuriant, and the abundant foliage and more tender tissues no doubt favour the penetration of the parasite.

Variety also plays a very considerable—in fact a preponderating part. Some sorts are exceedingly liable, yet others again are scarcely ever attacked. Sultana is one of the most susceptible varieties, Zante Currant seldom suffers, though curiously enough the first specimens received last season were Zante shoots. Among table grapes Red Malaga is extraordinarily liable, whilst Ohanez, Waltham Cross, and Doradillo are often severely attacked. Purple Cornichon, however, is less subject to the disease. Among wine varieties the following suffer much:—Alicante Bouschet, Carignane, Clairette, Grenache, Cabernet, Riesling, Malbeck, Cinsaut, Palomino, Chasselas, &c. On the other hand, the Pinots, Syra, or Shiraz, as we call it here, White Sauvignon, Mataro, Durif, &c., seem to be almost immune. The resisting power of certain sorts was recognised by older European vinegrowers, perhaps, more or less, unconsciously, with the result that resistant sorts were regularly planted in situations suitable for the fungus, and this to such an extent that prior to reconstitution Anthracnose was but little heard of. Modern vineyards have been replanted with many varieties new to the district. Vines have also been planted on low-lying situations

Fig. 1.

Anthracnose in spring, before blossom, when total destruction of crop may result—*a*, *b*, *c*, lateral growths resulting from the action of the fungus; *d*, damaged bunch; *e*, healthy bunch. After H. Mares.

Fig. 2.

Anthracnose in spring: damage to canes and leaves. After H. Mares.

previously devoted to other cultures, so that the disease is much better known in Europe than it was formerly.

Outward Appearance.

The outward manifestations of the disease are by no means unfamiliar in most districts after last season's visitation; nevertheless, there has been some confusion in places where it was less prevalent, the markings often left by Oidium on canes being sometimes mistaken for Anthracnose. The difference between the two is so great that to persons familiar with both diseases confusion is impossible. The scars caused by Anthracnose, especially those on the canes, are always sunken in, the depressed centre being usually surrounded by a more or less swollen rim or cushion of hypertrophied tissue. The markings — they can scarcely be termed scars —left by Oidium are discoloured, sometimes even rough, but they are never sunken in—the surface is always flush. That the two are altogether distinct is well seen in Figs. 4 and 5.

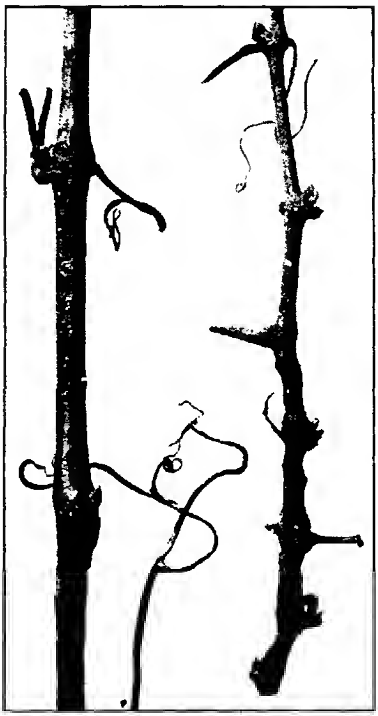


Fig. 3.
Anthracnose scars. Photograph taken in January, 1916. Verdeilho vines grown in Yarra Valley District.

The appearance of a vine badly attacked by Black Spot in spring is characteristic; (see Figs. 1, 2, and 3); once seen it is not easily forgotten. The young shoots are stunted, the leaves distorted, and more or less blackened, and the embryo bunches withered and corroded. All the growing parts of the vine are seared with black-edged scars, the leaves being often perforated by holes of varying size, rimmed with black. The vine looks as though it had been sprinkled with some corrosive substance, hence the popular French name of "Charbon" (charcoal).

French writers distinguish three different forms of Anthracnose, termed respectively Maculate, Punctuate, and Deforming. The first

alone seems to be caused by the true Black Spot, or Manginia Fungus; it forms the subject of the present article. Concerning Punctuate and Deforming Anthracnosis, various opinions have been expressed. According to Chappaz, they are merely manifestations of the rather obscure disease known in Southern France as "Court-noue" and are seldom of any gravity.

Maculate Anthracnosis, the disease we know as Black Spot, is undoubtedly caused by the fungus now botanically known as *Manginia ampelina*, V. and P.,* which may attack the young canes almost immediately after the breaking of the buds in spring. The earliest manifestations consist of small, isolated, light-brown spots, mainly on the green bark of the young shoot. They remind one of a miniature bruise, rather smaller than a pin's head at first. These spots become darker and increase in size, mainly lengthwise, assuming irregular shapes and ultimately forming the scars characteristic of the disease; these sink in as they spread, and eat more and more deeply into the woody tissues, sometimes penetrating as far as the pith (Fig. 3). Should several scars form close to one another the cane may be so weakened as to be easily broken off by wind. In early summer the centre of the scar is usually of an ashy-pink colour, surrounded by a black rim; this is characteristic. The pinkish appearance of the centre is caused by the summer spores or conidia, which are produced in enormous numbers at this season. The canes twist as though burnt; the partial destruction of vessels interferes with the sap supply, and the resulting starvation causes the canes to become stunted, and to send out numerous laterals and sublaterals, which give the vine a shrubby appearance. Scars varying in shape and size are thus formed on the canes, the appearance of which in the winter following is shown in Fig. 4.

Fig. 4.

Anthracnose scars on ripened wood on the vine in winter. After Viala and Pacottet.

* This fungus was formerly known by the names of *Sphaceloma ampelina* and *Glœosporum ampelophagum*.

Less damage is done to leaves, though they may be more or less severely riddled with black-edged shot holes of varying size, but usually small; scars occurring on the stalk and veins may cause contractions and distortions of very variable nature, which twist and deform the leaf.

In case of early attack, the floral organs may be damaged and blackened as though scorched by fire. Even if the visitation be less severe, the setting of the fruit may nevertheless be seriously interfered with. Later on either stalk or berry may be attacked. In the former case a portion, or even a whole bunch, may be cut off or damaged to such an extent that the berries remain small, with little sugar in them.

On the berry black bird's-eye like spots are formed, the centre becomes grey, or greyish-pink, and sinks in, but not so deeply as the cane scars; these spots are surrounded by a black edge. Irregular tension often causes affected berries to burst. The quality of the wine suffers quite as much as the quantity, the composition of the must being seriously interfered with; products are also secreted by the fungus which alter the flavour of the wine, often causing it to be faulty in constitution and keeping qualities.

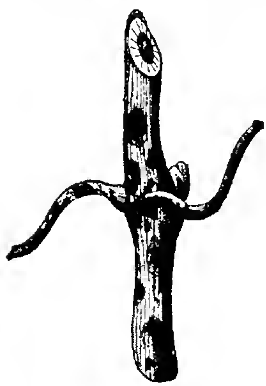


Fig. 5.

Blackened and mottled appearance of vine canes caused by Oidium—quite distinct from Anthracnose scars—compare Fig. 4. After H. Mares.

The most serious damage usually occurs early in the season, before the blossom, and vines badly attacked at this stage often lose their whole crop, the embryo bunches appearing as though badly charred (see Fig. 1). When the fruit is about half its full size, grave harm may also be done, the appearance of table and drying grapes being more or less damaged, and the quality of wine seriously impaired.

Damage is not confined to the season of the outbreak; the crop of the following year often suffers also. It is, in fact, very generally recognised that during the year following a severe attack, even though climatic conditions do not favour the re-appearance of the fungus, the vines make poor growth and show little fruit at blossom. The vine seems to have a languishing vegetation, and benefits much by stimulation with nitrogenous manures.

LIFE HISTORY OF THE FUNGUS.

That Manginia ampelina is a very old fungus is proved by the description given of it by agricultural writers of ancient Rome. It differs from most of the vine fungi, such as Oidium, *Uncinula spiralis*, Berk et Curt, Downy Mildew, *Plasmopara viticola* (B. et C.) de Toni, Black Rot, *Guignardia bidwelii* (E.) V. and R., &c., in that it has always existed in Europe, whereas these other fungi are all of American origin, and were unknown in Europe seventy years ago.

Until recently its life history was only imperfectly understood, but the researches of Viala and Pacottet, first published in 1904, have enlightened us very fully on the subject. These investigators found the fungus to be a most remarkable one, being extremely polymorphic, or, in other words, capable under given conditions of assuming a great variety of distinct forms.

Manginia differs entirely from Oidium (au external fungus) in that its mycelium* is internal to the tissues of the vine. The germinating spore sends out a filament or mycelium tube which penetrates the surface and spreads amongst the tissues, disorganizing them to such an extent that they sink in and form the characteristic scars on canes, leaves, and berries. In this internal nature of its mycelium it resembles most other vine fungi, and for this reason curative treatment is of no avail against it. It is evident that once entry into the tissues has been effected, the mycelium is sheltered from any fungicides which might be applied against it. In this it differs radically from Oidium, the external mycelium of which is readily got at and destroyed by sulphur, permanganate, and similar fungicides, thus rendering curative treatment not only feasible but fruitful of excellent results. The internal mycelium

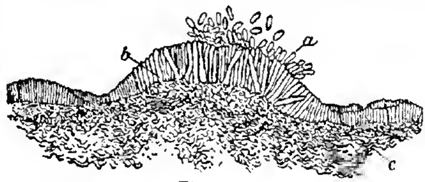


Fig. 6.

Diagrammatic section of a scar in early summer showing how spores *a*, are produced on the closely-packed, erect filaments *b*, thrown up from the more or less decomposed tissues *c*, containing the mycelium of the fungus, though the latter is not easy to distinguish. (× 450) After G. Foex.

The spores give the pinkish colour to the centre of the scar; they are produced in enormous numbers, and spread the disease if weather conditions permit of their germination.

of Manginia sends out spore-bearing filaments on which are born the conidia, or summer spores, by which the disease is spread during early summer. These filaments are closely packed, as is shown in Fig. 6, constituting a spore-bearing apparatus botanically known as a stroma.† Thus, a single scar arrived at the fruiting stage is capable of sending out an enormous number of spores. The production of these spores is marked by the ashy-pink colour of the centre of the scars already referred to. Until 1904 these were the only reproductive organs of the fungus which were really well known, though the existence of others was suspected.‡

In 1904 Viala and Pacottet, in lectures to students of the French Institut Agrinomoque described for the first time the true life history

* Mycelium is thus defined by de Bary—"Vegetative portion of thallus of fungi, composed of one or more hyphae." The mycelium is the growing (and feeding) portion of the fungus as distinguished from the spore-bearing or reproductive part. In edible, cultivated mushrooms it is popularly known as spawn.

† A stroma is defined by de Bary as follows:—Compound fungus body having the form of a cushion, crust, foliaceous expansion or erect unbranched or branched shrub-like body—same as receptaculum.

‡ In "Les Maladies de La vigne" (1893 addition) P. Viala quotes Goethe as having observed a kind of pycnidium on the swollen edges of Anthracnose scars—also Prillieux and Max Cornu, who had made similar observations. The similarity of the conceptacles to those of Black Rot led Cornu to think that the two diseases might be different forms of the same fungus. Viala has shown this opinion to be groundless.

of this most remarkable fungus as revealed by their investigation in artificial culture media. The results of these experiments were published at considerable length in La Revue de Viticulture in 1904 and 1905. In their introduction to this series of articles they show how—

> Cultures in various media, and study of the evolution of the parasite under natural conditions, permit amplification of observations previously published (R. Vit., Vol. XXII., pp. 117 and 145). The results obtained in 1904-5 . . . . reveal a complex polymorphism unknown in fungi of the same group, which causes Anthracnose of different plants. It was thought that this fungus had no other means of reproduction than a conidia-bearing stroma. In our cultures, in addition to this, we have obtained a second conidia-bearing form with macrospores, spermogonia, pycnidia, rhizomorphic sclerotia, and yeasts.
>
> These different forms exist also under natural condition as we have been able to observe in 1904 and 1905. In addition, in varied culture media . . . . we observed another form of reproduction, and probably of preservation not previously noted in fungi. To these we have given the name of *Kystes* . . . . These quite new facts . . . . have been checked for four years by numerous cultures varied in every possible sense. Investigations on the fungus of plane tree Anthracnose (*Glœosporium nerviseqnum*) presents similar evolution phenomena and organs of reproduction; likewise, with pea and bean Anthracnose (*Glœosporium or Colletotrichum lindemuthianum*).

A curious feature is that if the mycelium of Anthracnose is placed in liquid medium, containing sugar, it undergoes a radical transformation, changing gradually into a yeast-like, or unicellular sprouting fungus, similar in appearance and development to ordinary yeast, though of poor fermental power. All these different forms, when inoculated on grapes, reproduce the characteristic lesions of Anthracnose. These numerous transformations have been thoroughly checked by control experiments, which leave no doubt as to the accuracy of the investigations, and conclusively establish the remarkable polymorphism of the manginia fungus.

Further consideration of these most interesting transformations must be held over for a future article. The present one must deal mainly with treatment which, to be effectual, should be applied towards the end of the present, or early next, month (July and August). It will suffice now to state that during the growing period of the vine the fungus is spread by conidia or summer spores, whilst the winter or dormant period is passed in several different ways, viz., hybernating mycelium, sclerotia, kystes, and various less usual forms; only a few of these need be considered in the present article.

FIRST INFECTION AND SPREAD OF THE DISEASE.

Conidia or summer spores germinate in water, which is present in the shape of rain or dew drops; without these germination cannot take place. The spore emits a tube which is able to penetrate the cuticle, or outermost covering of the vine. It is only into green or herbaceous tissues that the fungus can penetrate; entry having been effected, the mycelium spreads in the surrounding tissues, which are disorganized, thus bringing about the formation of the scars characteristic of the disease. Development is rapid whilst the tissues are still green, and if weather conditions are favorable to the fungus, leading to wholesale destruction of shoots, and especially of embryo bunches already described. As the cane ripens the activity of the fungus lessens. The vine is also able to set up obstacles to its spread in the shape of layers of corky tissue which, if weather conditions become unsuitable for fungus growth, may succeed in isolating the infested parts from healthy tissue. Once the

cane becomes woody, the development of the fungus is much slower; nevertheless it sometimes continues to develop for several years in and around the scars first formed, and thus the wood older than one year may remain a source of infection.

Shortly after the scar has become distinctly formed sporulation takes place towards its centre which assumes the characteristic ashy-pink colour (Fig. 6), this continues for a while and then ceases. Hibernating or resting forms then appear.

As soon as the zone of the pericyclic fibres (the inner bark) is reached, . . . stroma appear on the sunken surface . . . which at once give birth to conidiophores (spore-bearing filaments).

The formation of these ceases about the end of July, or in August (January or February here). When the wood ripens, the fungus continues its vegetative life in the tissues, but conidiophores are no longer produced. Then, at the surface of the scar and in the fissures of attacked tissues, the mycelium condenses as sclerotic parenchyma.*

Before describing these sclerotia, a few other points in connexion with the vegetative stage of the fungus must be considered. The internal mycelium is very slender and difficult to observe, even with a high power microscope, especially in damaged tissues. It is more visible in cells which have quite recently been invaded.

As we have seen, it is only under certain weather conditions that the fungus can enter the tissues. Moisture in the shape of rain or dew drops is indispensable. Unlike several other fungi, however, the germination of conidia may take place at a fairly low temperature; hence the possibility of very early invasion. The spread of the fungus is, nevertheless, more rapid when the weather is both warm and moist.

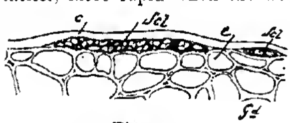


Fig. 7.

Diagram showing a small sclerotium of *Manginia ampelina*, *scl*, still covered by cuticle of vine *c*, cellular tissue of epidermis (bark) *e*, highly magnified.—After Gouirand and Bergeron.

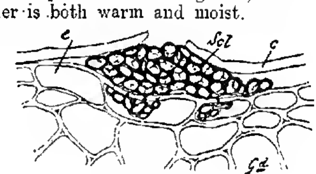


Fig. 8.

A rather larger sclerotium, becoming exposed by the breaking of the cuticle.—After Gouirand and Bergeron.

Another important, and to some extent re-assuring point, is the slow spreading nature of this as compared with other vine fungi, such as Oidium and Downy Mildew. This is distinctly stated by several French authors.

Fortunately this disease has not the galloping and widespread power of dissemination, and hence, of invasion, of mildew, black rot, or even of Oidium. Its attacks on flowers or young bunches can, no doubt, cause disaster in a vineyard, and exceptionally in a region, but, as a rule, Anthracnose remains localized in a block, or even on a few vines; here, canes, leaves, and bunches are more or less severely damaged; scars and non-setting of fruit are the result of its gradual and slow penetration into the tissues.—(F.P., in R. Vit., 8th July, 1915.)

Viala and Pacottet share a similar opinion—

An essential character of Anthracnose is its sporadic nature; it is nearly always confined to localized patches, whence it spreads progressively, but slowly. —(R. Vit., 14th December, 1905.)

* Viala & Pacottet, R. Vit, 14.12.1905.

This is entirely borne out by our experience in this State during the past few years. Though the abnormally wet spring was primarily responsible for the unusual virulence of the disease in situations suitable for it, Black Spot has for several years past been on the increase. At Mildura, for example, though there have been no severe visitations for about 20 years, complaints have been received from several growers within the past two or three years, and each season the manifestation has become more alarming. Influence of situation has here been very marked; only in depressions and parts of blocks where moisture was abundant has the disease shown up sufficiently to attract attention, and the arrival of normal, hot, dry weather nipped outbreaks in the bud. Nevertheless, the number of scars steadily increased, and in these, as

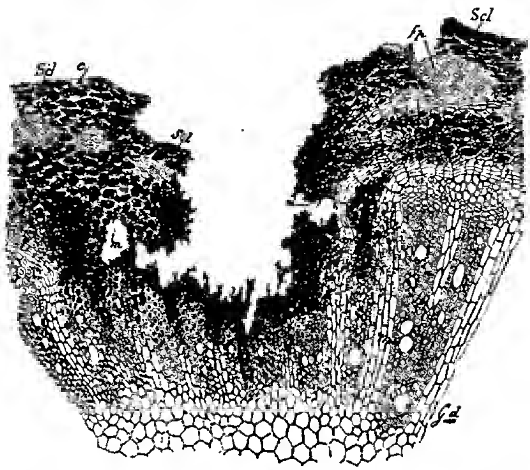


Fig. 9.

Magnified cross section through a deep scar, penetrating nearly to the pith, on a ripened cane. *Scl*, sclerotia. *Fb.* fibre bundles of bark. The blacker portions are tissues disorganized by the fungus; they contain closed cavities, *m*, in which sclerotia are also found.

From the irregular nature of the interior of the scar the need for very thorough swabbing, to reach all exposed sclerotia, will be realized. After Gouirand and Bergeron.

will be shown presently, the fungus passes the winter. Centres, or foci, capable of acting as starting points for an invasion, were more plentiful than usual, greatly favouring the spread of the fungus which, but for these numerous starting points, would not have been severely felt in spite of the unusually suitable season.

That this is so is proved by the fact that at Merbein, a comparatively new settlement, though only a few miles from Mildura, Black Spot was markedly less prevalent last season than at the much older Mildura settlement; at Merbein the disease had not succeeded in establishing itself. Likewise at Nyah, also a new settlement, Black Spot was so little in evidence last spring that few of the newer settlers know the

appearance of the disease. So far as climate is concerned, there is little difference between the three localities. In the new settlements there were evidently not enough starting points for the fungus to make an early appearance. In this respect Black Spot differs radically from Downy Mildew and Oidium; one vine affected with either of these diseases early in the season would suffice for the invasion of a whole district, but not so with Black Spot.

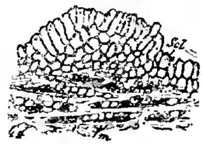


Fig. 10.

Completely formed sclerotium, highly magnified. Dark-brown outer cells above, central cells smaller and paler. Beneath is damaged tissue containing non-condensed mycelium. After Gouirand and Bergeron.

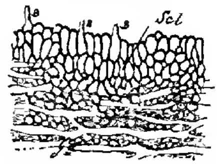


Fig. 11.

Sprouting of a sclerotium in spring. The surface cells are beginning to send out spore-bearing shoots *B*. After Gouirand and Bergeron.

Let us beware of placing too much reliance on this slow spread. After the outbreak last year, scars are to be found even in new districts where the disease was practically unknown then, and these are sufficiently numerous to permit of widespread infection should climatic conditions favour fungus growth. In all vineyards which suffered last year the number of scars, all of which contain the fungus in a dormant state, is simply enormous. The preventive treatment shortly to be described cannot therefore be too strongly recommended. To neglect it would be to court disaster.

Hibernating Forms—Sclerotia.

A sclerotium* is a resting stage formed by many different fungi. The curious formation sometimes ploughed up on new ground under the name of "native bread" is nothing else than a large sclerotium of a fungus known botanically as *Polyporus mytilla*, C. & M. The sclerotia of *Manginia ampelina* are similar in structure, though of far smaller size, being almost microscopic. This resting or wintering form of the fungus was mentioned by Goethe in 1878, also by Viala and Ravaz (C.R. 18/6/88.) It is dealt with at some length by Gouirand and Bergeron (R. Vit. 2/1/97), whose investigations throw considerable light on the action of the acid iron sulphate preventive treatment, which practical experience had shown to be effectual long

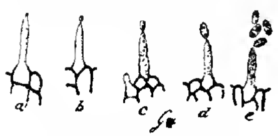


Fig. 12.

Spore production by shoots, the first stages of which are shown in Fig. 11. After Gouirand and Bergeron.

* The following definition is given by De Bary :—"Pluricelular Tuber-like Reservoir of reserved material, forming on a primary filamentous mycelium, from which it becomes detached when its development is complete, usually remains dormant for a time, and ultimately produces shoots which develop into Sporophores at the expense of the reserve material." (Comparative Morphology and Biology of the Fungi, Mycetozoa, and Bacteria, p. 499.)

before the details of its action were scientifically explained. In the last-named article these authors, after describing the manner in which the slender mycelium of the fungus in the deeper tissues gradually condenses near the surface to form sclerotia, describe the mode of action of the corrosive swab. The following is an abridged translation:—

The fungus only assumes the sclerotium form late in the season; it is seldom to be found in tissues attacked earlier. Sclerotia are sometimes to be found among bark fragments, but they are generally small. They are more developed on the edge of the scar, where they form a black zone. A section clearly shows the different stages of development; the smallest sclerotia are usually the furthest from the centre; these, often composed of only two or three irregular cells with brown walls, are situated between the epidermus and the cuticle (Fig. 7). The sclerotia continue to grow, and until they become large they are sheltered from external agents by the cuticle, and it is easy to understand that, under these conditions, iron sulphate solution may be harmless to them. When

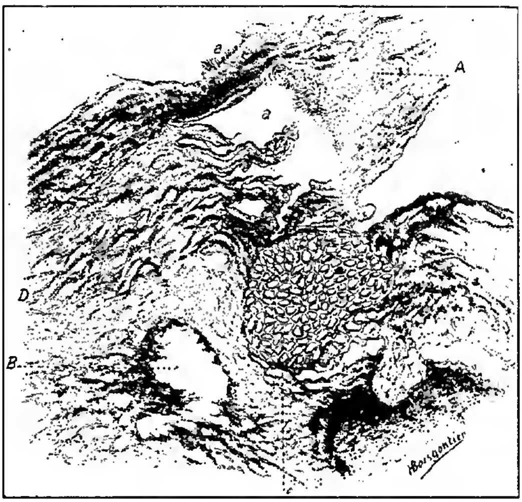


Fig. 13.

Section of portion of a scar in early spring of the season following its development, showing internal fissures, as at *B*; a sclerotium is shown at *A* which is sprouting at *a*, *a*; *C*, fibre-bundle of bark; *D*, tissue containing abundant mycelium of the fungus (× 100). After Viala and Pacottet.

they have grown larger they tear the cuticle (Fig. 8), and after a while become entirely exposed. They are also formed more deeply in the epidermis, and even in the tissues of the bark. Their thickness is then considerable, and the total destruction of the mycelium by swabhings becomes difficult (Fig. 9).

Sclerotia remain dormant all the winter. In spring, even at low temperature, development commences, as may be seen either on the vine or in the laboratory. It readily takes place on detached canes placed in the incubator in a moist atmosphere. At fairly low temperatures, in a cellar for example, they can develop and form spores. Thus is explained the earliness of the disease in spring. Our observations were made at 25 deg. C.

Sprouting and sporulation are then described in detail. Usually the surface cells throw out spore-bearing filaments (see Figs. 10, 11, and 12), but the more tender central cells can also produce spores if through any cause, such as breaking or splitting of the sclerotium, they become exposed. We have also proved that the non-condensed mycelium in the interior of the tissues can also emit spore-bearing filaments. Thus does the Anthracnose fungus perpetuate itself in spring.

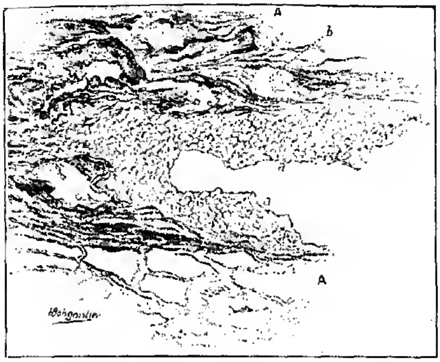


Fig. 14.

Section of a scar in winter (× 200), showing a sclerotium *a*, *a*, lining the greater part of a fissure cavity—it is now dormant; *b*, mycelium of fungus; *A*, *A*, streaky markings in the damaged tissues. After Viala and Pacottet.

Fig. 15.

Section made in spring of a similar fissure to that in Fig. 14 (× 200), showing germination of the sclerotium; this throws out from its whole surface an immense number of conidiophores or filaments which bear summer spores or Conidia *a*, *a*. After Viala and Pacottet.

The only treatments which seem to be really efficacious are preventive ones. As completely as possible the whole fungus must be destroyed. This can scarcely happen with the usual iron sulphate solution, or even with copper sulphate. In our tests we swabbed a number of vines with the following solutions:—Sulphate

of iron, 40 per cent.; copper sulphate, 20 per cent.; and sulphuric acid, 10 per cent. by weight. Control rows were left. Unfortunately, the following spring was not favorable for observations, as there was but little Black Spot. However, the new spots which did appear were much scarcer in the rows swabbed with dilute sulphuric acid.

Laboratory tests with solutions as above are described. The scars were very carefully swabbed, and, as soon as dry, the canes were placed in an incubator at 25 deg. C. in an atmosphere saturated with moisture. After two or three days, they were examined. If the sclerotium did not seem to have developed, thin sections were placed in a drop of water in hanging drop culture. Under these conditions development is very rapid, and, after a few hours, spores formed. Trials made in spring, before the vines sprout, gave the following result:—Scars treated with iron sulphate alone developed in every case, often almost as fast as controls. Sometimes the filaments even seemed longer and more vigorous than in the case of controls, no doubt owing to the slight acidity derived from the iron sulphate. Traces of iron sulphate seem to rather favour the development of certain fungi. Results were about the same with canes swabbed with copper sulphate. Nearly all the sclerotia developed, the filaments

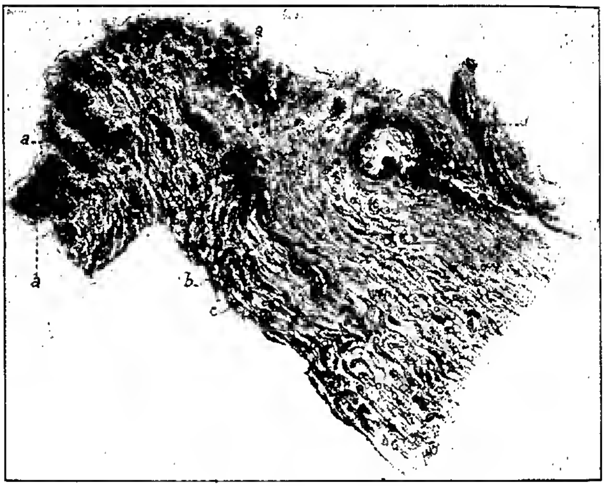


Fig. 16.

Surface view of a sclerotium fragment taken from a ripened vine cane—*a*, *b*, Kystes (small roundish bodies) at the surface of the sclerotium, which is visible at *c*; cane tissue broken down by the parasite is seen at *d* (× 100). After Viala and Pacottet.

appearing to be longer and more vigorous than on controls. Sulphuric acid, on the contrary gave a quite different result. Sclerotia thus treated were like horn in appearance; they became brittle, and whatever were the conditions under which they were placed they never developed.

Conclusions.—Iron and copper sulphate solutions are absolutely powerless to kill Anthracnose sclerotia; swabbings with these salts give quite insufficient results. If they have any efficacy, it can only be in spring, when the sclerotia are in course of development. The cells of the outer layer are then thinner, more active, and less capable of resistance; this, no doubt, explains why the later it is applied the more efficient the treatment.

Below the layer of cells destroyed by the remedy, the unattacked fungus tissues can, as shown above, produce new fructifications. This explains, perhaps,

the good effects noted in the case of two successive treatments, but, when a sufficiently thick layer of outer cells has been destroyed, an obstacle to the formation of fresh fructifications is established. This is what occurred in the case of sulphuric acid. Hence the value of the usual classic acid iron sulphate treatment (1 per cent. acid). Nevertheless, in Medoc, according to Boyer de la Giroday (R. Vit., Vol. V., p. 515), 10 per cent. sulphuric acid has been even better. Bouchard, the proposer of this treatment, has found it entirely satisfactory.

If it be desired to use iron sulphate, it would be well to add to it a fair proportion of sulphuric acid.

Viala and Pacottet hold similar opinions, though they are not quite so reassuring—

Viticulturists know how difficult it is to combat Anthracnose by preventive treatments with acid iron sulphate. They know also that the action of the swab is only really efficacious if applied shortly before the buds sprout.

In order to reach the internal sclerotia, impregnation, or diffusion, of the corrosive liquid through the tissues is necessary; this can, however, only act on the conidiophores at the moment of their formation, or else on the spores which they have produced. Even though the acid iron sulphate reach the sclerotia, it can only corrode the first layers of parenchymatous cells, without penetrating to the interior, unless it were to burn and destroy the tissues of the canes. It is thus easier to understand the efficacy of double treatment with acid iron sulphate, with a fortnight's interval between each application. Even then it is conceivable that their efficacy is not absolute.

Sclerotia are not only formed on the surface of scars, they are also found in deep cavities and fissures where they may be beyond the reach of the swab; they are, of course, altogether so in internal cavities (Fig. 13. Conidia formed therein are, however, powerless to infect young growth in spring. The most dangerous sclerotia are those in deep narrow fissures, where the swab can scarcely penetrate (Figs. 14 and 15).

It may be here explained that Fig. 9 and Figs. 13 to 16 are reproductions of drawings made direct from the microscope; though they are exact representations of what is actually seen, they probably convey less to those unaccustomed to microscope work than diagrams such as Figs. 6 to 8 and 10 to 12, which are conventional, and drawn to illustrate certain points only.

From these extracts the need for very thorough treatment will be readily understood. In addition to sclerotia, kystes must be briefly referred to. These small bodies, which seem to be another resting form, develop at the surface of the exposed sclerotia on the scars. (See Fig. 16.) They are no doubt washed by rain on to the main stem of the vine, where they remain until the following spring, and germinate on the return of favorable weather conditions. These, as well as some other resting stages, render necessary the treatment of the old wood of the vine; if sclerotia were the only wintering form, it would only be necessary to treat the young wood on which the scars are situated.

TREATMENT.

It is evident that the artificial destruction of all hibernating forms would remove the cause of infection, and prevent a fresh outbreak the following spring, hence the efficiency of the winter swab, which was practically demonstrated long before the life history of the fungus was thoroughly investigated. Foex (*Cours Complet de Viticulture*—1886 edition)—mentions swabbing with concentrated iron sulphate solution, a treatment invented by M. Schnorf. He further states that, according to M. P. Skawinski, better results are obtained by using newly manufactured iron sulphate, which contains 1 per cent. of free sulphuric acid. Thus was evolved the acid iron sulphate swab, which is still the standard preventive treatment. As has been shown above, Boyer de

la Giroday found later (about 1895) that dilute sulphuric acid alone was capable of giving good results.

All authorities are in agreement as to the immense superiority of preventive winter treatment over summer, or curative applications, made whilst the vine is in active growth. Prevention is better than cure. In connexion with this fungus, the old adage is peculiarly appropriate. The winter swab is undoubtedly the standard treatment. Spring or summer applications can only be looked upon as supplementary, they may do some good, but too much must not be expected of them. Summer treatment may be held over for the present, though it may be briefly explained that it includes dusting with dry mixtures of lime and sulphur and spraying with Bordeaux mixture, or other copper-containing sprays; the last-named seem to be the more effectual.

The Winter Swab.

From the above it is evident that both concentrated iron sulphate solution, and 10 per cent. sulphuric acid, are effectual destroyers of the resting stages of Black Spot. Each, however, has its disadvantages. The first must be very strong (about 50 per cent.) in order to be effectual; at this strength it must be kept warm and applied warm to avoid crystallization, and this is inconvenient in practice. Ten per cent. sulphuric acid is very corrosive, and requires careful handling. It has a rather drastic action on the vine, sometimes causing the wood to split in an alarming manner, especially if dry, windy weather follows its application. A compromise, in the shape of a combination of both of the above formulæ, would seem to be the best way out of the difficulty. In France, very varied formulæ are given by different authorities, the amount of sulphate of iron varying from 10 per cent. to 50 per cent., and that of sulphuric acid from 1 per cent. to 10 per cent. It would appear that the greater the sulphuric acid strength, the less iron sulphate is needed, and *vice versâ*. The action of iron sulphate is somewhat obscure; this salt is a poor fungicide as compared with copper sulphate. Nevertheless, the latter seems quite useless, at least against the resting stage of the fungus; it would, no doubt, be more active when spore production has commenced in spring.

Taking all these facts into consideration, we are led to recommend the following as the most generally satisfactory formula:—

Iron sulphate, 35 lbs.
Sulphuric acid, 3 to 5 lbs.
Water, 10 gallons.

For convenience in measuring the acid, it may be mentioned that an ordinary wine bottle (reputed quart size) holds 54 oz., or nearly 3½ lbs. of sulphuric acid.

The solution, being very corrosive, must not be placed in receptacles made of any metal other than lead; it can be most conveniently handled in wooden vessels, preferably painted or paraffined inside and out, and with hoops tarred or paraffined before being driven on. To make it, place the iron sulphate crystals in the tub, pour the sulphuric acid over them, add the water, and stir occasionally until dissolved. If hot water be used, solution will be more rapid.

Another way of making it is by tying the sulphate of iron in a piece of hessian or bagging, and suspending it in the upper part of the water in which it is to be dissolved, the sulphuric acid being added after

solution is complete. In this case the usual precaution of pouring in a thin stream, with constant stirring, must be taken, so as to avoid dangerous splashes, which are not to be feared with the first method of preparation.

It is well at this stage to warn growers against placing any reliance on copper sulphate solution, Bordeaux mixture, &c., as a winter swab: as shown above, these are quite useless against the fungus in its resting stages. The addition of copper sulphate to the winter swab has also been recommended. It can do no good, and is merely a waste of copper sulphate, which is very expensive at present.

The same may be said of lime-sulphur solution, used successfully by orchardists to combat other fungi, and sometimes recommended for Black Spot. It may possibly prove of use, as Bordeaux mixture does, for summer treatment, though it has not yet been properly tested. As a winter swab it has no value, since it can have no action on the very resistant sclerotia which only yield to a corrosive application.

WHEN TO SWAB.

The best time is as near the bursting of the buds in spring as possible. Unfortunately, the exact date of this cannot be forecasted exactly; the season may be a week or so early or late. If too long delayed, there is danger of being surprised by early sprouting, and once the buds start growth swabbing must be discontinued, as it would corrode and destroy any growing tissues.

The efficacy of a double swab, with a fortnight's interval between each application, has been referred to. A safe method is to swab three or four weeks before sprouting is expected, the application being repeated on the worst affected patches just before the buds break.

One effect of the swab is to retard sprouting, sometimes by even as much as a fortnight. In districts liable to spring frosts, this delay may be a distinct advantage; it has sometimes meant the saving of the crop. The appearance of the vines after treatment is curious, and to some extent alarming, as they are blackened and discoloured; no damage, however, need be feared with the formula given above, provided the buds have not commenced to move. The first growth of treated vines is usually apt to cause anxiety; the young shoots at first appear to be sickly and to make poor growth. This is, however, only temporary, and development soon becomes normal. After a short time treated vines will be found to make more vigorous growth than untreated ones.

Early swabbing is not recommended; in midwinter the sclerotia seem more resistant than in very early spring. It is well to swab trellised vines before the rods are tied down, in order to spare the wires as much as possible from damage by the corrosive solution.

Late sprouting also favours varieties liable to faulty setting at blossom, such as Malbeck. A delay of a week may mean striking more favorable weather for this important function. The swab also destroys several animal pests such as scale insects, Erinose, &c.; it is, however, quite useless against the wintering forms of Oidium and Downy Mildew, notwithstanding opinions sometimes expressed to the contrary. Zacharewicz states that it prevents Crown-gall (Broussin).

How to Swab.

From the theoretical considerations which precede, it is evident that in order to be effectual, swabbing must be very thorough; something more is necessary than a mere sprinkling. The whole vine, and more particularly all scars, must be wetted so thoroughly that all corners and recesses in which sclerotia are often hidden will be penetrated by the solution. It is evident that in this respect two applications (as already advised) are better than one; the second may reach scars missed by the first.

The newest wood (rods and spurs) no doubt requires closest attention, but the whole of the older wood, main-stem and all, must be well wetted with the swab, so as to destroy any kystes and other resting stages which may be harboring on or under the rough bark.* Some years ago the removal of this rough bark was recommended. Such work is costly, and does not seem to be necessary. Pacottet considers a thorough wetting with the acid solution as quite sufficient. Should removal of the old bark be decided on, all fragments must be carefully collected and burnt; to strip the bark and leave it on the ground near the vine would be worse than useless. Likewise with prunings; on patches severely visited by the disease last year, these should be completely burnt, and care taken to see that no fragments are left lying about.

Swabbing is usually applied by means of a brush—an ordinary whitewash brush will do. The solution being very corrosive, the brush cannot be expected to last long. The only brushes which are at all suitable are those which are free from metal parts and are bound with string instead of wire. A small mop made of woollen rags, tied to a wooden handle, may also be used. The method of application is of less consequence than its thoroughness. A convenient appliance is mentioned by Brunet in his recent work on vine pests.†

M. Magen has devised a special implement for the winter swab, which is known by the name of "Le Continu." It consists of a lead-tined receptacle of 2¼ gallons capacity, a rubber hose, and a brush. The liquid is conveyed by the hose to the centre of the brush, which is held by the workman. When the hose is flowing, the brush is continually saturated with the solution.

Something similar to this could, no doubt, be easily improvised, it being too late to import these implements. A tap made of lead, between the hose and the brush, would no doubt prove useful for regulating the flow of liquid.

Spray pumps are largely used in France, but they must be of special design, since an ordinary spray pump would soon be destroyed by the corrosive liquid. Pumps designed for the purpose have receptacles made of glass, or lined with lead, which metal is capable of resisting sulphuric acid. The rubber hose can resist the solution fairly well, but the nozzle must be made of lead or ebonite; ordinary nozzles would corrode very rapidly.

The spray is said to be of cheaper and more rapid application than the swab, though it is doubtful if it is as thorough; there must also be a considerable loss of liquid with the former.

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* In South Africa it is considered advisable to swab trellising posts.—See *Agricultural Journal of South Africa*, July, 1906. "In the Vruchtbaar flower garden a few vines grow on a high trellis supported by wooden posts. The vines, but not the posts, were treated (with acid iron sulphate) and the result was that the disease was almost as bad as if nothing had been done wherever new shoots grew close to the posts."

† Raymond Brunet. Maladies et Insectes de la Vigne, p. 76.

When swabbing, the brush or mop should be drawn along spurs or canes from the base towards the extremities, so as to avoid breaking off buds.

The quantity of solution required to swab an acre naturally varies with the number of vines and their development. According to South African experience, 10 gallons of solution suffice for 250 trellised or 500 bush vines. In most of our trellised vines 15 gallons should swab an acre.

In conclusion, all growers who suffered through Black Spot last season, and also those who observed any trace of the characteristic black markings last summer, or who can now find scars on last season's canes, are strongly advised not to neglect the standard swab, as per formula given above, early next August. Where last year's visitation was severe, the double swab is recommended, a first application towards the end of July being repeated early in August.

Very badly affected blocks can, with advantage, receive an additional spraying with Bordeaux mixture, or copper soda, in September, when the young shoots are 3 or 4 inches long, repeated a little later should wet weather persist. Though copper mixtures, and even copper sulphate (bluestone) have been shown to be quite useless as a winter swab, this does not apply to their action during the growing period of the vine. If the surface of all green tissues be well protected by the presence of copper in a slightly soluble form, the germination of summer spores of Black Spot will be prevented in similar manner to that of the spores of other plant diseases usually combated by copper-containing sprays.

THE POLICY OF "THAT'LL DO."*

By W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer.

The cry for economy, ringing through the world at the present time, has prompted me to draw attention to channels in which it can be applied. These, for convenience, I group under the title of this address—The Policy of "That'll Do." The cry, though it has been heard, has not, I think, been fully appreciated in this land, which has for its greatest pest at present a plague of mice working havoc in the country districts, and to combat which a fight is necessary.

How much more serious is that fight which is proceeding to rid the world of a pest that not only destroys grain, but everything it comes in contact with, and is laying waste the whole country-side and destroying the most valuable asset of any country—human life! One of the greatest weapons that can be used against this foe is economy. With its use we will be enabled to store up silver bullets, which we have been told on so many occasions will win the war.

How many of us really realize how acute the cry for economy is? In a recent issue of the daily press a cablegram stated that in Kent, in England, a woman was fined £5 for throwing into a dustbin 4 lbs. of pieces of bread; and a Colonel in Bedford was fined £100 for feeding

* Paper read at the Annual Convention of the Chamber of Agriculture held at Bendigo, July, 1917.

his fowls on wheat. What would we in Australia think of such happenings on our shores? Surely it must bring home to us the serious position of affairs in the old world, and the necessity to see that there is no waste. For what we waste is lost to the Empire. This war will teach us many lessons, if we will only learn them; many of them are lessons which should be known by heart, without the horror of war as master. During the early hostilities Mrs. J. C. Henderson conceived the idea of collecting and making use of old newspapers, and from this source a sum of £500 has already been raised for the Lady Mayoress' Patriotic Fund. More recently the collection and sale of old tooth paste tubes has been undertaken for the same purpose, thus indicating that what we in the past have considered only rubbish is of some value when directed into proper channels.

Now let us look to the farm and see what waste is going on, and how the policy of "That'll do" is responsible. Recently an officer of the Dairy Supervision Branch of the Department of Agriculture pointed out to a dairy farmer that his employees were not stripping his cows thoroughly. He had been under the impression that when the milkers had come to the conclusion that "That'll do," and got up from the cow, nothing further was necessary. He was induced to pay some attention to the matter, and the first week was rewarded by a return of 56 lbs. of butterfat more than for the previous week. Another, milking 53 cows, had come to the conclusion that "he would get out of cows, as there was not enough in them." The management was very much of the "That'll do" order, and, following the milkers, my officer found that there was an average of 1 pint of strippings left in each cow. Strippings test anything up to 15 per cent. or more. Let us consider them at 10 per cent. only, then 53 pints of strippings with 10 per cent. butterfat, equals 6.6 lbs. of butterfat left in the udders. At 1s. 6d. per lb. this means, in round figures, that 9s.9d. was being lost at each milking—approximately £1 per day, or £7 per week. No wonder it was time to leave the industry. And this farmer was not, and is not, singular. Many there are who are quite content to engage their milkers and, with a sigh of content, say "That'll do." Suppose only half a pint of strippings (and this is a conservative estimate) was left in each cow in the State daily for a milking period of 9 months, what is the loss to the industry? If any of you care to work it out you will find that over £1,000,000 is lost annually.

Take another instance, of the farmer separating his, say, 200 gallons of milk a day. His separator when new did excellent work, but the careful directions given as to how to run it are lost or forgotten. As age creeps on the separator rocks a little, is not quite adjusted, or there is not quite sufficient speed obtained—"Oh, that'll do, let her go"—and in the separated milk butterfat goes away to the extent of 1 per cent.; up to 2.4 per cent. has been found by officers of the department. The estimated average loss in separated milk in Victoria is .5 per cent. What does this amount to? In round figures there will be 180 gallons of skim milk, then 9 lbs. of butterfat are going to waste each day: at 1s. 6d. per lb. this equals 13s. 6d. per day to the account of "That'll do" in a herd yielding 200 gallons a day. Extend the figures to the whole of the cows in the State and I will leave you to see the preventable waste going on. I hear some one say, "It is not waste, for the pigs get it." Any one who is satisfied to feed pigs on butterfat at 1s. 6d. per lb. is too

firm an apostle of the policy of "That'll do" to be influenced by any remarks of mine; but to those who seek light I would say that the amount of fat lost in separated milk should never exceed .05 per cent. How often have you tested or had tested your skim milk? How often have you sat down and thought about the cows you keep, instead of being up and about to try and find out which cows are keeping you? Under normal conditions fully 25 per cent. of cows are living a parasitic life upon the remainder of the herd. To find them out it would be necessary to weigh their milk and test it periodically. The reply to this suggestion nine times out of ten is that it means extra work. If you would carry it out for a little while you would find it saved work; there would be less to milk and feed and more money to spend.

Mr. T. Mesley, of Dalyston, a well-known breeder of Jersey cattle, who has recently entered his herd for Government testing, in forwarding his cheque for an account which had been rendered, stated: "I consider the money well spent. What I thought would be a humbug and worry has become a pleasure, and I now look forward to the visit of your officers, and the returns, in expectation. It is a great pity that farmers could not be induced to take up herd testing as a whole. for the sake of the industry, and if at any time I can be of any service in assisting to induce farmers to adopt herd testing I will be only too pleased to do so."

There is a dairy farmer near Melbourne who, on the question of feeding his cows, is satisfied that "That'll do" is a losing policy. What he wants is good cows that will produce the greatest amount of milk for the least money, and his experience to date is that 15 lbs. of concentrated food and as much chaff as the cows will eat is the cheapest—and that is their present ration. He milks 46 cows, pays for all labour (the milkers obtaining £2 per week and keep), and, after paying all expenses, rent, labour, feed, makes a clear profit of £10 per week. He boasts that he has nothing to do but walk about with his hands in his pockets. Literally this is true, for he does no manual labour, not even milking, but he is working with his head and looking for better feed and better methods.

How does the policy of "That'll do" affect the quality of your produce? On a great many dairy farms cleanliness is conspicuous by its absence. "That'll do" reigns in respect of all operations from milking to sending the cream to the factory once a week, and we find that of the 13,415 tons of butter exported last season 32 per cent. was below first grade. Suppose we put the difference in price as between first grade and this 32 per cent. as low as 1d. per lb., we find a difference of £9 6s. 8d. per ton, or over, a season of very small export, a loss of £40,000; then add to this the loss from inferior butter on the local market. Why should we not supply all first grade butter and save the greater portion of this amount?

Now turn to pig raising and see what this policy costs. In most instances in pig farming the pig must have a sty, so a few old logs or rails are obtained and a sheet or so of iron, or part of an old tank, are put together some distance from the house, but as near the dairy as possible, with the farmer's blessing of "That'll do." Bedding is probably provided—at first—but it is not long after the pig is introduced to his new home that the ground becomes saturated with rain, fæces, sour milk, and *débris* of all kinds, and the sty attains the condition

which justifies it being held up as an example of the greatest degree of dirt that man can compare anything to, with the words "as dirty as a pig sty." It should be as dirty as man can make it, for the pig is not responsible; he must wallow in it in winter without a dry spot to lie on, and be tortured by the sun and flies in summer. His trough is seldom cleaned out; it becomes sour and stinking. Suddenly there are numerous deaths, particularly with the young ones, or they won't thrive, and become fit subjects for disease, and the verdict goes forth "There's nothing in pigs." Try and estimate what the loss to the industry is through bad management and this policy of "That'll do." Look on the other side of the picture. What animal of the farm is there that will breed, fatten, and return profits so quickly when managed correctly? Would you not all like to get 9s. per bushel for your wheat? That is what it is worth as food for pigs when pork is 9d. per lb., but it is necessary that an effort should be made to obtain this return, in the direction of widening your sphere of operations and working for it. There is a mistaken idea in the minds of many that pig-raising can only be carried on in conjunction with dairying, but the sooner this idea is exploded the better it will be for the community, and the sooner will our flocks and herds be restored to their normal, or, as they should in a growing country, show an increase.

It does not say much for our progress that 23 years ago (in 1894) there were more cattle in Australia than any other period of our history, and 26 years ago the greatest number of sheep were held, the figures being as follows:—

MAXIMUM NUMBER OF CATTLE, SHEEP, AND PIGS IN AUSTRALIA

Cattle in 1894	.. ..	12,311,617
Sheep in 1891	.. ..	106,421,068
Pigs in 1911	.. ..	1,110,721

The maximum number and present number of cattle, sheep, and pigs in Victoria:—

			Maximum.		Present.		Decrease.
Cattle	..	(1894)	1,833,900	..	1,175,098	..	658,802
Sheep	..	(19[illegible]7)	14,146,734	..	12,576,587	..	2,570,147
Pigs	..	(19[illegible]0)	350,370	..	254,436	..	95,934

Will any one question the truth of the following: Seeding is on, and in the evening return is made to the homestead with the dray, in which is a bag of wheat. The question is asked: "What shall we do with this wheat?" How often is the reply on the following line?:—"Oh, we are going out again to-morrow. Leave it in the dray. That'll do." The horses are put away for the night, but the bolt is off the stable door. You meant to put those screws in every day for the past couple of years. Or the rails are broken; you meant to bring a new one in every time you went out to the timber. Well, it can't be helped to-night, so "prop it up with that bit of sapling. That'll do." In the morning the wheat is missing, and half-a-dozen valuable horses are rolling in pain; before many hours are past two or three are dead, others foundered, and some hundreds of pounds has been lost for ever.

Sheep farmers, does "That'll do" cost you anything? Shearing is over. Probably there was an odd tick found on the sheep, so "That'll do"; you are too busy to dip, or, maybe, there is hardly enough dip left. "Put some more water in; that'll do," or, "I am going to sell the lambs, so dip the ewes only; that'll do." But some of the lambs

are not sold, and the flock is reinfested. What is the loss? "Crow-foot," in the *Pastoral Review* (republished in the *Journal of Agriculture*, February, 1916), conducted some experiments, and found that dipped sheep cut from $\frac{3}{4}$ to $1\frac{1}{2}$ lbs. more wool than undipped ones, and increased in body weight 3 to 5 lbs., showing a profit of 2s. $7\frac{1}{2}$d. per head over the undipped, and this experiment was conducted on clean sheep. How much greater would be the difference on sheep which have to spend part of their lives rubbing and biting themselves in an endeavour to allay the irritation of ticks.

Take another stage of farm work. Harvest is over, and the machine is brought back from the fields. The farm hand asks where to put it. "Under that tree, or against the fence; that'll do." Next year new canvas is required, or some part has rusted, warped, or split, and requires renewal, and before many years a new machine is also wanted. I think you will agree with me that the majority of farmers do not provide sufficient accommodation for their machinery, and those who oil or paint it before putting away for the season could be easily counted. Have you ever stopped to think what it costs you for this neglect, or to make good preventable waste in directions such as this?

How does this policy apply to breeding operations? There are two stallions travelling in your district—one with a Government certificate standing at £4 4s., and one without, standing at £2 2s. How often is the verdict given for "the cheaper one; that'll do," without thought of the value of the progeny, which may vary from £20 for the cheap one to £50 or more for that of the dearer and better horse? Or, amongst the cows again, how many farmers are there who are quite satisfied so long as they get calves? Any old squib of a bull will do for the purpose, and Victoria's average yield per cow is in the region of 350 gallons of milk, instead of 600 or more, and the progeny of valuable cows in your herd deteriorate instead of improve. I am glad to say that this aspect of breeding is now receiving more attention at the hands of dairymen than formerly, and a number are looking to the bull to improve their yields, but there are still far too many content with "That'll do." Some years ago, in order to improve the lot of irrigation settlers and the breed of their cows, the Department purchased a number of pedigree Jersey bulls and placed them on the settlement. A fee of 5s. was charged for service, and the holder of the bull was entitled to free service for 20 cows. The settlers were very thankful, but it was necessary to take the cows, perhaps, some little distance, and it became much easier to open the gate and let in that stray bull, which was wandering the roads. Slowly the Government bulls were removed. One I can quote was sold to a farmer near Melbourne, who is very grateful to those settlers, for his bull has paid for himself over and over, as he stands at £1 per service, and cows from a distance are taken to him, besides which his owner has a most promising herd of young stock coming on. At the present moment the Department owns one of the finest bulls in Australia, who can shew in his pedigree all the finest strains of blood that ever came out of the Island of Jersey, either for show standard or butter production, and he is practically begging for a home amongst the settlers, who must mainly depend for a living upon butterfat. They have, however, come to the conclusion that, as the steers by a Jersey bull are not of much value and meat is so dear just now, any old bull bought in the local yards with a bit of frame is the one "that'll do." Follow this policy a little further, and see that farmer replenishing his herd with cows bought in

the local sale-yards—cows that he knows nothing about as producers and which in many cases introduce disease to his herd, to cause still further waste. Examples of disease so introduced may be found in pleuro-pneumonia, abortion, and contagious mammitis, the loss from which amounts to many thousands of pounds per annum.

Illustrations such as these could be extended almost indefinitely, but I think sufficient have been given to indicate the loss and waste that is going on. It has been said that silver bullets will win the war, and I hope these remarks will augment the supply, but we must remember this: A country is only as rich as the people who inhabit it; the greater the assets of the individual the greater the wealth of the country, and the more opportunities there are for progress. Every penny that is paid into the private account of the individual increases the national assets. When you pay your farm cheques into the bank you surely don't think the bank just hoards it up for you? It is said that money is made round to go round, and in its course it adds to itself. At the present time the most important additions are bullets. The more each one of us can save the more sure is the end of the war. But to save to the utmost we must abandon the policy of "That'll do"; nothing but the very best will do.

The price of foodstuffs the world over has increased enormously. In Great Britain the cost of living has gone up 100 per cent. Can you fancy paying 2s. per lb. for mutton, or 2s. for a plate of soup at a restaurant, or £45 for store bullocks? Notwithstanding this, the production has not increased to any extent; and for many years to come, but more especially upon the cessation of hostilities, the demand for food for Europe will be enormous. Should we not be ready to supply portion of that demand? It behoves the head of every family in Australia to convert himself into a Commission of Inquiry into the management of his own home and work, with the object of eliminating waste and storing up for his own benefit, but, above all, for the benefit of the Empire, bullet after bullet of silver, or of food products, which are the equivalent. "That'll do," however, must be cut out of his vocabulary; only the best will do.

In this way we will be able to show that we are not only a fighting branch of the family of Britishers, as has been so gloriously shown by our representatives in Europe, but also that we are a peaceful branch, and one which can offer opportunities not surpassed in any land to that large army of workers of all classes who, at the conclusion of the war, will turn their eyes from the crowded areas of the old world to fair fields and lands of glorious sunshine.

The Prime Minister of Australia (Mr. W. M. Hughes), in his open letter to the farmers of Australia, as published in the April issue of the *Journal of Agriculture of Victoria*, says:—"The citizens of this fair country stand and watch the progress of this mighty war as a crowd watching a fire afar off. Many of their number, hearing the faint cry for help, have plunged into the maelstrom of death to succour human life. . . . Australia's duty in this great crisis is obvious. We must make available in increasing quantities the products necessary to enable the Empire and its Allies to win the war. I appeal to you, the primary producers, therefore, to stand behind your fellows in Europe, and leave no stone unturned to see that their pressing food requirements are forthcoming."

Those of you who are unable to enter the maelstrom as depicted, have a duty pointed out. This duty can, I think, be extended to see that not only is the present emergency met, but that the future is provided for, and that you should at once commence to gather together and form those materials which will be so urgently required to re-establish on commercial lines our great and glorous Empire.

WEEDS.*

By H. W. Davey, F.E.S., Orchard Supervisor.

In writing this paper I do not claim to be an expert on all weeds that, unfortunately, tax the man on the land, but I have given a good deal of consideration to combating certain noxious plants, and have conducted many experiments for their eradication, notably the worst of all our weeds—St. John's Wort.

In the following paper, as one who knows the difficulties in dealing with certain weeds, I have not recommended treatment that often is quite impracticable on steep country. In advising the frequent cutting of perennial weeds, which is usually a costly process, it is really the cheaper method to attack the thing properly and eradicate the pest than to make a lot of half-hearted efforts that will never eradicate the trouble, but instead allows the plants year after year to gradually extend their grip on the land, while still maintaining their hold on what they have.

The number of introduced species of plants that rank as weeds is becoming greater every year. This is another instance of an introduced species displacing the indigenous. A plant, like an animal, is always more or less subject to natural controls in its native country, and these controls usually are absent when a plant is introduced into new surroundings. This lack of control often allows an alien plant to get completely out of hand unless vigorous steps are taken for its suppression. The same plant in its native country is often a host for numerous enemies in the form of insects or fungi, that either kill it or control its seed production; but in a country like Australia, with its favorable climate and soils, these alien plants find more ideal conditions for their propagation and dissemination. As a result they often spread to an alarming extent.

The seeds of weed plants may be introduced into a country in many ways, chief of which may be by dirty seed being imported. Packages and their packing are another source of supply, and ships arriving from foreign countries in sand ballast—the latter being often used for reclamation purposes is a common source for the invasion of noxious plants.

Once introduced the means by which they are spread over the country are many, among which may be mentioned: Stock feeding on the plants and the seed passing through them with their germination unimpaired; birds that eject from the mouth indigestible portions of their food in the form of pellets, such as our magpies, are the principal

* Paper read at the Annual Convention of the Chamber of Agriculture held at Bendigo, July, 1917.

agents in the spread of briars and blackberries, and in this respect the imported starling may in all probability be a very serious proposition. If these pellets are examined many seeds will be found in them, but more especially those belonging to the two plants mentioned.

Birds may travel a long distance after feeding on plants of this description before the pellets are ready for ejection, and thus the seeds would be scattered over wide areas. Many seeds are carried in the hoofs of travelling stock, while the hooked seeds, such as the various burrs, are carried in the coats of animals, to be dropped later on, or the burr may discharge its seeds on the way. Again, as is well known, many seeds are wind-borne.

Stock trucks are also excellent agencies for the spread of weeds. The droppings in these dry and become pulverised, and later when strong winds blow through these trucks this dry matter is swept out on to the adjacent country through which the train is passing. On one occasion I found a very strong patch of St. John's Wort growing inside the fence between Yendon and Navigator stations, on the Geelong to Ballarat line, and there appears to be but little doubt that the seed was blown out of a truck that had passed along this line.

In all probability irrigation channels are the worst offenders of all in the spread of weeds. These channels run through miles of country and carry all kinds of seeds floating on the water, some of which find lodgment on the banks, where ideal conditions exist for their growth. These plants again shed their seeds into the water. Later on the water is taken from these channels for irrigation purposes; the seeds are then distributed all over the irrigable lands, and are a menace to all landowners in the areas which are served by these channels. I would suggest that all channel banks be laid down in grass to check weed growth as much as possible, and when weeds do make an appearance they most certainly should not be allowed to seed, otherwise the lands served by these channels must necessarily become overrun with noxious weeds of all descriptions.

Dredging and sluicing for gold has undoubtedly been a big factor in the spread of St. John's Wort, and especially so in the Avon shire, where on one occasion I noticed this weed being sent down the Crooked River in bunches, most likely to find lodgment and root itself miles further down stream.

Weeds, like other plants, may be put into three classes, viz.:—Annuals, Biennials, and Perennials. An annual comes up from a seed, bears flowers and seeds, and then dies, completing its life cycle in one year. A biennial grows from a seed, but only produces leaves the first year. The roots live throughout the winter, and in the second year of its life it produces seeds and afterwards dies. A perennial is a plant that lives on for a number of years, and usually produces flowers and seeds every year.

Weeds reproduce themselves in various ways, viz.:—By means of seeds, roots, runners, suckers, &c.

Knowledge is always of value, and even a slight botanical knowledge is of help to the farmer, for to be familiar with the life history of any weed is of assistance when combating it. The loss from weeds in this country is much greater than is usually thought, and constitutes a heavy tax to the man on the land. In many instances weeds depreciate land values to a very serious extent.

Destroying weeds by the use of arsenical preparations is of very little value except for the purpose of freeing paths, &c., from vegetable growths. The use of arsenic against deep-rooted perennials is absolutely useless unless used in such quantities as to completely destroy the fertility of the land. Various tests were carried out at Bright with all kinds of arsenical preparations for the destruction of St. John's Wort. These applications were found to be immediately fatal to all growth above the surface, but did nothing to prevent fresh growth being pushed up from the strong root system below. When arsenic was used at sufficient strength to destroy these roots it was found to completely destroy the land for two or three seasons and render it useless for the growth of plants. A much better weed-killer for young plants is crude petroleum or kerosene. This, when sprayed over them, destroys the plants, but leaves no ill-effects on the soil.

Salt is an effective weed-killer and one that in many parts of Victoria improves the fertility of the land. Salt is a deliquescent substance which extracts water from the moisture in the atmosphere and the surrounding objects that it comes into contact with. Thus when applied to succulent plant tissues it draws water from them, and produces an effect similar to scorching. Thus it is of special value when applied to the roots of weeds after they have been cut or bruised, as it draws the sap reserves of the plant to the surface, where it is then evaporated.

Much has been said about cultivation for the suppression of noxious weeds. This is easy when dealing with annuals that occur on arable lands, but it is useless to talk about cultivation on lands unfit for cultivation either on account of their contour or composition. If lands are steep, or have stony outcrops, they may be first-class grazing lands, yet totally impossible to bring under the plough, and it is to this class of land that the menace of the introduced weed looms large. If lands can be brought under the plough, and good cultivation given at short intervals, the most obstinate plant can be destroyed, for if the leaves are kept from forming the crude sap sent up by the roots cannot be elaborated, and the plant starves to death, as sap is of no use to a plant until it has been dealt with by the leaves, and returned as plant-building material. The mistake is often made in allowing too great an interval between the stirrings of the soil, with the result that leaves are formed and pushed through the surface of ground in the short time between the cultivations, with the result that sap is elaborated and the plants again renew their strength. Unless cultivation is frequent it cannot kill such plants as St. John's Wort, Canadian thistle or blackberries.

The reason why so many weeds are troublesome on grazing lands is not always so much on account of their greater vitality or powers of reproduction, but in the fact that, on account of their less attractiveness and rejection by stock, they have an unfair advantage over the more succulent herbage, and while the latter is being eaten down close the weed is allowed to grow and develop its seed. Instances of this can be noticed on railway enclosures where Kangaroo grass is usually plentiful, yet outside the fence, on account of close feeding by stock, it has almost disappeared. This grass, providing stock is kept from it, can completely suppress St. John's Wort, but as soon as stock and

rabbits get at this grass they eat it out, so that St. John's Wort again takes possession as soon as competition from the grass disappears.

This seems about on a par with planting coniferous trees to suppress this plant. The close planting of pine trees on Crown lands would, in all probability, successfully arrest the spreading of this pest to clean land, providing the pine belt was a wide one. But in regard to privately-owned land the owner does not want pine trees; he wants to put his land to other uses, such as grazing. It has already been stated that Kangaroo grass will smother St. John's Wort, but to enable it to do this it would be necessary to exclude all stock, including rabbits, for a considerable time. After the weed has disappeared and the stock returned, dormant seeds would in all probability reinfest the land as soon as the stock had eaten down the controlling grass.

One thing that must forcibly strike any one who has given any thought to weed suppression is the very lax way in which the Thistle Act is administered by some of the shires in Victoria. In some shires proclaimed weeds can be noticed growing in the yards of public buildings without restriction of any kind, and along the footpaths and main streets in some of our large inland towns stinkwort may be seen growing abundantly.

In this paper it is only intended to deal with a few of our worst weeds, and, as the first essential in dealing with any weed is to prevent it seeding, this applies to all of them. In fact, the three main principles of weed control are (*a*) to prevent weeds from going to seed; (*b*) preventing the introduction of weed seed; (*c*) preventing perennial weeds from making top growth.

Cutting weeds down is frequently practised, but often this work is done so late that the seed has already been shed or is distributed in the process of cutting, or it is so far advanced in growth that it is enabled to continue the ripening process after having been cut down, and if the tops are not afterwards gathered up and burnt little benefit has been derived from the labour and expense of cutting.

With perennial weeds such as the Canadian Thistle (*Carduus arvensis*), where cultivation is practised as well as cutting, the former agency often tends to increase the trouble by distributing the underground stems or rhizomes about the land being cultivated, unless the rhizomes are carefully raked up and burnt. Cultivation at frequent intervals will, as has already been stated, kill any plant, as this destroys the leaves, which are really the lungs and the stomach of plants; but, unfortunately, this plant is possessed of extraordinary vitality, and its roots, even when cut into very small fragments, can produce shoots.

Pulling up plants that have running roots rarely injures the root system. The plant pulled up usually breaks off at the point where it is attached to the horizontal root, leaving the latter undisturbed.

The horizontal root system is often below the reach of the plough, and while the farmer is busily engaged in pulling and cultivating to destroy the plants appearing above ground, the root system is continually sending up new shoots as soon as the cultivation is relaxed, although they have been weakened according to the frequency of the cultivation. In fact, the only practicable method for destroying roots of this class is to starve and exhaust them by preventing the formation of leaves or stems above the surface of ground, and so prevent the elaboration of sap, and, in addition, make salt applications.

Unfortuuately for the farmer when perennial weeds appear in cultivated lands the difficulties often increase, as the only crops permitting clearing operations being carried out throughout the growing season are root crops, and, though cereals can be cut for hay on land badly infested with St. John's Wort (*Hypericum peforatum*), this does nothing towards suppressing the pest, as while the crop is growing the weed is recovering.

Recently I saw a paddock that had been continuously cropped for seven years past in infested St. John's Wort country. The land in question had four ploughings a year. Last year it was put out of cultivation, with the result that St. John's Wort was a heavy crop on this land, and possibly heavier than before cultivation took place. St. John's Wort, being of an extremely inflammable nature, should be burnt wherever possible, as this alone would destroy enormous quantities of seed, and it should be cut down to prevent its seeding at all. The best time to cut this plant is when the flowering stems aro well advanced; this also applies to other weeds, as reserve forces are lower at this time, they having been used to a large extent in forcing up flower stems. A salt application at this time increases the shock and destroys the plant. This plant thrives best in loose soils, no matter how poor and stony they may be, the deep root system enabling them to obtain the necessary moisture. It does not thrive so well in the heavy clay soils, although iu these the plant will seed freely, and seeds would be more easily transported from these soils in the feet of stock than in soils of a lighter uature.

Apart from dredging, the seed is not water-borne to the extent that is generally believed, for, although the seed must be shed into streams in immense quantities from plants overhanging the water, it would, soon after falling, sink to the bottom.

In my opinion, the chief medium of its spread is by means of stock movements from infested areas, and also by fodder grown in badly infested districts. Another factor in its spread on Crown lands is, I believe, through the medium of rabbits. These, when dashing through a crop of the weed, when the seed is ripe, cause lots of it to be showered down upon them, and this either falls or is scratched out of their fur probably on land previously free from the weed, as the seed is very small and dustlike. The ease with which new centres of this weed can be established can readily be understood when it is borne in mind that this seed will germinate in 28 days.

St. John's Wort has a wide range, beiug indigenous to England and through Europe to China. It is the species that has proved such a pest in Victoria since its introduction about 30 years ago. It is commonly known in Bright as the Racecourse weed on account of its rapid spread over that reserve many years ago. This plant is perennial, having herbaceous stems crect, and two-edged, of reddish colour, which stool out freely from the base, forming a cluster of upright stems, sometimes reaching to 5 feet in height, but more commonly about 3 feet, and carrying at their tops bright clusters of yellow flowers, which later on form three-valved seed capsules containing a great number of small seeds. The branches and leaves are opposite. The latter are small, having smooth edges without stalks, and are in form elliptic-oblong about half an inch long of a bluish green colour, and copiously supplied with oil glands showing as pellucid dots on the surface. It is from

the presence of these oil glands in its leaves that the plant derives its specific name of perforatum, because when held against the light these oil-glands give the leaf the appearance of having been pricked or perforated by a needle point. This feature affords one of the most ready means of definitely identifying the plant.

THE BLACKBERRY (*Rubus fruticosus*).—This plant is rapidly becoming a very serious pest in most of the southern districts, and chokes everything else out of existence, with possibly the exception of St. John's Wort, the flower stems of which can often be noticed standing above the centre of a mass of tangled blackberry. This is an introduction from Europe. The plant itself arises from a perennial root-stock, and soon forms an almost impenetrable mass of bramble, yet affording harbor to vermin of all descriptions. Blackberries are difficult to get rid of. When old-established masses are to be dealt with fire will often reduce them to an extent to make cutting easier. Two or three cuttings a year with salt applications will destroy the plant if carefully done, and if the situation is easy of access. After clearing away all the surface growth by cutting and burning, the clump of blackberries, if not too large, can be killed right out by covering the spot with iron, bark or sheets of tarred paper—in fact, anything that will exclude the light completely. Magpies after feeding on this fruit eject the seeds later from the mouth in the form of pellets, thus distributing the seed over wide areas of country.

SWEET BRIER (*Rosa rubiginosa*). This is another perennial pest plant that has taken possession of large areas of country, and is a difficult plant to eradicate. Old plants should be dragged out of the ground after wet weather by means of a horse and chain, and the resultant shoots kept cut closely down, and the roots treated with salt applications. This is another plant the seeds of which are distributed far and wide by means of birds that feed on its fruit.

FURZE (*Ulex europaeus*).—A prickly evergreen shrub, also a perennial, and, as its specific name implies, is an introduction from Europe. This is easier to eradicate than most of the perennials. The plant should be dug up before flowering and burnt, and the mass of seedlings that usually spring up afterwards could be destroyed by spraying them with crude petroleum or kerosene.

AFRICAN BOXTHORN (*Lycium horridum*).—This plant has quite taken possession of large areas of land in parts of Victoria, having been largely planted as hedges, and is a great harbour for starlings and sparrows, and also some troublesome pest insects. The seeds are being distributed broadcast by the agency of several species of birds. This plant should not be allowed to be used for the purposes of hedging, but should be grubbed and burnt.

BINDWEED (*Convolvulus arvensis*).—A perennial weed that is often very troublesome in orchards and wheat lands. The Convolvulaceæ to which this plant belongs is a very extensive order of plants, mostly consisting of herbaceous and twining shrubs. All the species have in a greater or less degree an acrid juice, which is strongly purgative, and in the species under consideration the roots abound in a milky juice which is highly so. Good cultivation is recommended, followed by raking up and destruction.

PATERSON'S CURSE (*Echium violaceum*).—This is a biennial plant, and is a native of Austria. The name Echium is given to this genus

on account of the seeds having a supposed resemblance to the head of the viper. It is rather an extensive, and certainly a pretty, genus, 70 species having been described. Paterson's Curse is easily recognised by its dark blue flowers; it is a coarse-growing plant and smothers the grass. At present it is fairly plentiful in the north-eastern parts of Victoria, and is getting well established on the railway line between Everton and Bright. It is rather a difficult plant to pull up on account of its strong grip of the soil, and its flower stem is very rough and hairy, necessitating the use of gloves if much has to be pulled. Pulling it before flowering followed by salt dressings is best treatment on land that cannot be cultivated. Close feeding by sheep is useful when plants are young.

STINKWORT (*Inula graveolens*).—This plant is spreading rapidly, especially in the northern part of Victoria, where it has become firmly established, and the seed also is being distributed by means of water in the irrigation settlements. The plant is an annual, and would not be difficult to deal with if it was not such a sturdy grower and so prolific a seed-bearer of feathery type. On grazing, waste lands, reserves, and roads this weed should be pulled or hoed out to prevent seeding, otherwise the enormous amount of seed produced in these situations is sufficient to smother all the land in the district. Where ploughing is possible this should be carried out. Heavy stocking with sheep will destroy the plant when young.

BRACKEN (*Pteris aquilina*).—In some parts of the State this fern is becoming a very serious pest, especially so on land that previously carried heavy timber which has since been cleared off. The land being unsuitable for cultivation, on account of its steepness, the rhizomes cannot be destroyed. Land that carried good grass a few years ago is now densely covered with bracken ferns to such an extent that the grass is rapidly deteriorating and its stock-carrying capacity is fast dwindling away, and it will not be long before much of the hilly country is entirely covered by this fern. The best method of dealing with this pest on land that cannot be cultivated is by means of cutting and salting. The reason why the former method often gives such poor results is because the ferns are cut too early or too late. The best results from cutting are obtained if done just previous to the ferns sporing; they should be cut down close to the ground. Two cuttings a year will be necessary, and the second year's cuttings generally destroys most of the ferns. Salt applications are very effective when applied immediately after the cutting.

BATHURST BURR (*Xanthium spinosum*) is a native of Europe, Asia, and Africa. This plant should be hoed out when young, and not allowed to seed. Unfortunately it is common on road-sides, and wandering stock carry its seeds in their coats, thus spreading it on to land previously free from it.

ONION GRASS (*Romulea cruciata*) is an introduction from Africa. This is a most difficult plant to eradicate, more especially as it delights in hard, closely-compacted soils. Cultivation does not suppress this plant so easily as is often thought, on account of the great vitality of its corms. Deep ploughing does not suppress it, as the corms send up leaves to the surface from considerable depths. The best methods of eradication appear to be by improving the humic content of the soil and keeping same as loose as possible.

Ragwort (*Senecio Jacobæa*).—This plant is an introduction from Europe, and belongs to the same genus of plants as the common groundsel, and, like that plant, produces an enormous number of wind-borne seeds, which conduces to its rapid spread when neglected and allowed to run to seed. This weed should be taken in hand as soon as noticed, as, besides destroying the natural grasses, it has the reputation of causing fatal sickness among horses. In last month's (April) issue of the *Agricultural Gazette* of N.S.W., by J. H. Maiden (Government Botanist) writes:—"The other is the Ragwort (*S. Jacobæa*), which is common in Victoria, but, so far as I know, it has not been officially recorded as having made its appearance in New South Wales, although I am perfectly certain it is in the State. In the Cape of Good Hope species of Senecia are recorded as having induced cirrhosis of the liver in stock, and in New Zealand *S. Jacobæa* is blamed for the similar and fatal complaint amongst horses known as 'Winton disease.'"

As showing what can be done in weed eradication by a council alive to the interests of landowners, it is worth stating here that the Colac Council expended this year upwards of £500 in the extermination of noxious weeds. This council started a Ragwort competition amongst the schools in the affected areas, with the result that 2,187,303 plants were pulled and burnt, and a sum of £367 2s. was paid to the school children competing.

On lands that cannot be cultivated plants should be hand-pulled just before the flowering stage is reached. and afterwards burnt. With immature plants cutting them low down is advised. followed by salt applications immediately afterwards.

Hemlock (*Conium maculatum*) is another introduction from Europe and Asia. This species is biennial, and produces quantites of seed from its small whitish-coloured flowers, and is highly poisonous. Unfortunately this plant is spreading rapidly in some districts. It thrives best in deep soils in localities having a good rainfall. Land on which this plant is growing should be cultivated wherever possible, and under no circumstances should it be allowed to seed. Hand-pulling is effective on large plants; small plants should be mown and a dressing afterwards made with salt. Hemlock has caused the death of children and stock that have eaten it.

In conclusion, it may be pointed out that many landowners are careless about a new plant when it first makes its appearance on their land.

Any strange plant should be identified, and if it is of value it can be allowed to remain, but otherwise it should be immediately destroyed. so as not to run unnecessary risks by allowing it to become established. I have often been surprised at the indifference shown by many farmers to strange weeds appearing on their land. A wider knowledge of alien plants must be of benefit to all, and there appears to be a grand opportunity here for the Education Department to include noxious weeds in its nature-study lessons. because if children in the country schools were taught to recognise useless or dangerous weeds they could destroy them should they make their appearance in their district.

In addition to this, they could pass on this knowledge to their parents, so that paddocks would not become overrun with pest plants before their identity became known, as so often happens at the present time.

THE CHEESE INDUSTRY AS IT AFFECTS THE VICTORIAN FARMER.*

By R. T. Archer, Senior Dairy Inspector.

In this paper I do not purpose dealing with the manufacture of cheese in detail, but to place before you some other aspects of the industry. The following figures clearly illustrate the importance and the possibility of the cheese industry in Victoria:—

IMPORTS INTO BRITAIN—OUR PRINCIPAL OUTLET.

	1910.	1911.	1912.	1913.	1914.	1916-17.
	£	£	£	£	£	£
Butter ..	24,493,450	24,600,619	24,354,193	24,083,658	24,014,276	—
Cheese ..	6,809,876	7,140,012	7,414,191	7,035,039	7,966,162	—
Of this Australia sent—						
Butter ..	3,566,952	4,604,284	3,225,886	3,210,733	2,274,044	—
Victoria sent—						
Butter ..	23,684 tons—£2,500,000.				13,415 tons—£2,700,000	
Australia sent—						
Cheese ..	10,772	36,749	4,903	24,568	57,584	—
Victoria sent—						
Cheese ..	7,957 (139 tons)	—	—	—	—	107,000 (1,091 tons)

New Zealand sent—

Cheese .. 1915, £2,730,211; 1916, £3,514,310; 1917, £3,100,168.

Canada sent—

	1910.	1911.	1912.	1913.	1914.	1916-17.
Cheese ..	4,424,806	4,590,515	4,347,832	4,038,627	4,025,950	—

The following figures show the development of the New Zealand cheese industry:—

1866.	1876.	1886.	1896.	1906.	1916.
cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
13	885	16,657	71,372	131,206	949,416
£	£	£	£	£	£
65	3,488	45,657	130,166	341,002	3,514,310

IMPORTS OF PIG PRODUCTS TO BRITAIN.

	1910.	1911.	1912.	1913.	1914.
	£21,634,740	22,763,536	£22,678,806	£27,817,954	£28,400,311
From Victoria	..	..	..	..	.. Nil

Cheese exported to Britain this season, *i.e.*, 1916-17, from Victoria is greater in amount and value than in any previous year, amounting to 1,091 tons. At 9¼d. per lb., f.o.b., the price allowed by Government for first grade cheese amounts to over £100,000. Mr. P. J. Carroll, in his review of the past season, given at the Conference of the Butter and Cheese Factory Managers' Association, said:—"The quality of the cheese submitted for exports reflects the greatest credit on the manufacturers; the average score was close on 91 points, and over 90 per cent.

* Paper read at the Annual Convention of the Chamber of Agriculture held at Bendigo, July, 1917.

of the total quantity was of first grade quality. Most of the cheese was four to six weeks in store prior to shipment, and was five to six months old before reaching its destination."

Many consumers in this country are under the impression that good cheese cannot be made here, and that if they wish to have a bit of good cheese they must purchase New Zealand-made cheese. In years past much of the Victorian make has been sold as New Zealand, and anything inferior in quality as Victorian. The results of the export of cheese to Britain should go far to dispel this illusion. While full reports from London are not yet available, cables have been received to the effect that experts appointed by the British Government have classified a large quantity of cheese which was forwarded to London as equal to the best New Zealand in quality. For this the Victorian makers would receive the same price as the New Zealanders.

In 1911 a shipment of cheese was sent to London, and the report on this was very satisfactory. The following extract from a report from one of the largest importing firms in Britain speaks for itself:—"The quality of Victorian cheese per s.s. *Cornwall* is very satisfactory, and a great improvement upon what we had from Queensland last year.

"The character of the cheese is more like that of Canadian than New Zealand. On the whole, the coloured cheese shows up better than the white. The crates in which the cheese are packed are very rough and badly made, and it would be a great advantage to have the wood planed and the corners and edges of the boards rounded off, after the style of the New Zealand crates. They look very common and rough, and some of them are far too big for the cheese. It is more difficult to sell crates that contain three cheese, and they do not command such a good price as those that contain two. We like cheese weighing about 80 lbs. each."

If cheese-makers will benefit by the instructions given by Mr. Geo. Sawers, Cheese Instructor of the Department of Agriculture, there will be no difficulty in producing an article that will hold its own in competition with that of New Zealand and Canada. The trouble is that very frequently they will not give the time and attention necessary. If they try to rush the work through as quickly as possible, body and texture suffers, and there is also loss of fat.

Greater uniformity in weight of cheese and style of package is necessary. It should always be borne in mind that an attractive get up is of great assistance in selling the contents. It may be assumed that the same care has been taken in manufacture as in preparing for market.

MARKETS.

U.S.A.—The increase in imports of cheese to U.S.A. from 1900 to 1914 was more than 50,000,000 lbs. annually. While the total production of cheese is steadily increasing the amount per head of population is decreasing. The same thing applies to butter and other products, and America should, in the future, be a market of ever-increasing importance for Australian food products.

Britain.—According to London authority, the average consumption of cheese in England and Scotland was 504,000,000 lbs. per year, of which 302,400,000 were home made and 201,600,000 imported. Year by year the amount of milk consumed in its natural condition is increasing, which means less cheese manufactured at home, leaving a greater opening for the manufacturers of Australia and other countries now being

developed. It is estimated that 12¼ lbs. of cheese is cousumed per head of population in Great Britain.

A Cheese Pool.

The amount of cheese now produced in Australia is much in excess of requirements. If it were not for a good proportion being exported there would be a glut, and prices would be unremunerative. When shipments have been arranged for in previous years in order to relieve the market, the prices locally have risen above London parity. Those who exported did uot receive as much for their cheese as those who did not export, and thus were placed at a disadvantage. It was only by some exporting a considerable amount that better prices could be obtained on the local market; then why should one section of the producers receive an advantage by the sacrifice of another section. It would be fairer if the cheese were pooled as the butter has been, and only the necessary proportion of the output from each factory kept here to supply the local demand. The Queensland cheese-makers have had some such arrangement amongst themselves for some time past. The number of cheese factories (including farms) in Victoria are about 23 co-operative and 147 proprietary and private—about 170 in all.

Payment for Milk for Cheese Making.

The Dairy Supervision Act provides that all milk purchased for the purpose of manufacturing into cheese shall be paid for according to its butterfat contents, as ascertained by the Babcock or Gerber test. This was decided after very exhaustive inquiry as to the most equitable basis for payment. It is, however, very difficult to get some people to realize the wisdom of this provision. In all countries where cheese is manufactured on an extensive scale, this has been a much debated question, much investigational work has beeu done, and the system generally adopted is the butterfat test. Another system, more complicated, but more thorough, was perfected in America by Professor Hart, known as the Hart Casein Test, in which both the fat and the casein are estimated, fat and casein being the two principal ingredients of cheese, but it has been decided that the fat test is quite satisfactory. To demonstrate the difference in value of milk of different quality for cheese making, a series of experiments were undertaken by Mr. Geo. Sawers and myself, using milk of different quality. The results given below should be convincing.

Should milk for cheese making be bought on its butterfat contents or by the gallon?

The answer is given by the six cheese referred to above, particulars of which follow:—

Nos.	1	2	3	4	5	6
Weight of milk, lbs. ..	500	500	500	500	500	500
Percentage of fat	5·4	4·7	4·2	4·0	3·8	2·6
Weight of cheese	58½	56½	55½	53½	51½	46½
Value at 6d. per lb. ..	29s. 3d.	28s. 3d.	27s. 9d.	26s. 9d.	25s. 9d.	23s. 3d.
Equals per gallon of milk at ..	7·02d.	6·78d.	6·66d.	6·40d.	6·18d.	5·58d.
500 lbs. milk at 1s. per lb. butterfat	27s.	23s. 6d.	21s.	20s.	19s.	13s.

Each cheese was made from 500 lbs. of milk of different butterfat content. For convenience it is valued at 6d. per lb.

Milk with lowest test, viz., 2.6 per cent., made 46½ lbs. cheese, equals 29s. 3d., equals 5½d. per gallon.

Milk with highest test, viz., 5.4 per cent., made 58½lbs. cheese, equals 29s. 3d., equals 7d. per gallon.

Milk testing 3.8 per cent., gave 51½ lbs. cheese at 6d., equals 25s. 9d., equals 6d. per gallon.

Milk testing 4.7 per cent., gave 56½ lbs. cheese at 6d., equals 28s. 3d., equals 6¾d. per gallon.

To obtain the different percentages of butterfat, cream had to be added or extracted. Normal milk would show greater variation, as the solids vary, to a large extent, in proportion to the butterfat.

Based upon the investigation of 15,000 cheese factory payments for milk, a Wisconsin bulletin (No. 267), prepared by Mr. J. L. Lammis, states that in paying for cheese milk the straight fat test method gives satisfactory results in 95 per cent. of all cases, while in the other 5 per cent., where there is constantly a greater difference of 1 per cent. of fat between the richest and poorest milk received in the same month, a newly-suggested system, whereby a decimal .6 is added to each supplier's test, is recommended as the easiest method of reckoning correct payments. It is generally calculated that on an average 1 gallon of milk will yield 1 lb. of cheese, but, as seen above, the richer the milk the greater the amount of cheese made. As a fact, at a factory in Gippsland last year at one time 1¼ lb. of cheese was being made per gallon of milk, cheese of good body and texture, and not containing any excess of moisture.

CASEIN.

A number of factories have installed plants for the manufacture of casein, for which the price, for some time past, has been ruling high. This has enabled those factories to pay a much higher price for butterfat—over 4d. per lb. in some instances. It should not be forgotten, however, that before the war the price for casein was very low, about one-third of the present price—too low to leave any margin for profit. Again, casein is not manufactured for food, and it is evident that the greatest requirement at the present time is for food.

WHEY.

Because whey has a very watery appearance, many farmers conclude that it has very little value as an article of food, whereas quite the opposite is a proved fact. Although it contains only about 7 per cent. of solids, this is nearly as much as some of the root crops grown for stock food, especially some of the turnips, and while all of the solids in whey are digestible and assimilable, a considerable percentago in roots consists of indigestible fibre of no practical food value. For calves, if fed sweet off the curd, quite satisfactory results are obtained, when meal of some kind, especially linseed meal, is mixed with the whey. As a matter of fact, one of our leading stud Ayrshire breeders rears his cattle largely on whey, with the addition of meal, providing, when possible, a good grass run. For pigs, also, whey is very valuable. Two pounds of whey are equal to 1 lb. of skim milk, and as 3 gallons of skim milk will produce 1 lb. of pork, 6 gallons of whey will produce 1 lb. of pork: so if pork is worth 6d. per lb., that would be a penny a gallon for the whey for feeding pigs, of course in combination with grain feed of some kind.

CHEESE OR BUTTER.

Is it advisable to undertake the manufacture of cheese in preference to butter? At the present time there can be very little risk in diverting

a large percentage of the milk into cheese. The outlook for the cheese market at present is better than for butter. There is a sure market at good prices. The price is likely to be higher next season than in the past, as Canada is getting 1s. and over per lb. for this season's spring make. It is considered that the War Office will not pay less than 10d. next season, and 10d. per lb. means 10d. per gallon for milk, equal to 1s. 10d. per lb. for butterfat, less (say) 2d. per lb. for working expenses, leaving a net return of 1s. 8d. per lb. for butterfat.

Another point in favour of cheese is that it forms one of the most important items of the diet of the soldiers. If there is difficulty with regard to shortage of freight, cheese will have the preference over butter.

CHEESE AS A FOOD.

Cheese is believed to be one of the oldest dairy products known to man. It was evidently in the form of cheese that milk was first preserved for later use as food. Like many other of our foods, cheese is very complex in its composition, and while we are familiar with its general character, and know something about the amount of protein and fat it contains, we know very little about the make-up of these materials as they occur in a well-ripened cheese. The cheese-maker has to deal with a complex material, milk, which is peculiarly susceptible to contamination. To this is added rennet, also complex in its nature, and then by means of salt and by controlling temperatures during making and ripening periods, the matured product is formed. Naturally when there is a variation in the controlling factors, that is, in the amount of salt or in temperature, there will be differences in the nature of the product, and these differences not only affect the texture, but more especially the flavour and aroma. Thus it will be seen why from three such common substances as milk, salt, and rennet it is possible to make such an innumerable variety of cheese as is found on the market to-day; furthermore, why it is absolutely necessary that the cheese-maker should have full control of the conditions under which the ripening takes place if he is to get a uniform product.

Cheese is of two classes—those which are mild in flavour, and those which are seasoned or ripened in such a way that they are highly flavoured. The latter, like almost all highly-flavoured foods, are commonly used to season dishes made of ingredients without much distinctive flavour, or are used in small quantities at a time to give palatability to a dish or meal. The mild-flavoured cheese are those which are usually selected for eating in quantity, and are those which may be most suitable when cheese is used as a substitute for meat.

From an economic stand-point, cheese is important, because of its high nutritive value, particularly its high percentage of protein or muscle-forming ingredients, on account of the ease with which it can be kept and prepared for the table, and because of its appetising flavour. To show its high nutritive value it is only necessary to point out that 1 lb. of good Cheddar cheese contains nearly all the protein and fat in 1 gallon of milk. Approximately it is composed of one-third water, one-third fat, one-fourth protein, and, in addition, small quantities of mineral matter or bone-forming material, salt, &c. Beef contains 50 per cent. water or more, and the leaner it is the higher will be the water content. Thus beef has a much lower nutritive value than cheese, and the same statement holds good with practically all forms of meat.

In Britain, cheese forms a large proportion of the daily diet of the lower-paid classes. In Australia it is generally looked upon as a luxury, to be eaten in small quantities at the end of a meal. This is due to the fact that the value of cheese as a food is not appreciated. Some people complain that cheese produces indigestion, and so cannot be eaten in any quantity. This is frequently due to the fact that it is only eaten at the end of a meal, when the stomach is already supplied with as much material as it can conveniently treat. If cheese, which is highly concentrated, being all digestible, is added in any quantity, it is easy to realize that the digestive capacity is overtaxed. If eaten in a proper manner, it is very easily digested.

Extensive experiments have been carried out by the United States Department of Agriculture to ascertain by actual trials what proportion of the cheese was digested and what effect it had in the system when eaten in large quantities. The work was planned to include new and ripened cheese. The cheese was made by the regular Cheddar process. The ripening was carried on under different conditions. One lot was ripened under factory conditions, where the temperature varied from 50 to 75 degrees Fahr. Two lots were stored immediately after making, and one was kept at 32 degrees; the other at 40 degrees Fahr. Another lot was held in the factory curing room for two weeks, and then placed at a temperature of 40 deg. Fahr. All these methods of controlling the ripening process were carried out with cheese made with 3-oz. rennet to 1,000 lbs. of milk and with 6-oz. to 1,000 lbs. of milk.

The subjects of these experiments were students of the University. The diet consisted of whole-wheat bread, bananas, and cheese. Of the latter substances from 450 to 600 grams. were eaten in three days of the experiment, or about one-third to nearly ½ lb. per day. The number of experiments completed was 184. Without going into details of the results, it may be stated that there was little or no difference in the digestibility of the cheese at different stages of ripening. The perfectly green curd was evidently as digestible and, so far as nutritive value was concerned, was as good as the same cheese at any stage of ripening. The cheese was highly digestible, and though it was eaten in comparatively large quantities it was well assimilated. The record of the health of each individual shows that there was little or no digestive troubles, and that the green cheese caused no more trouble in this way than the ripened article. Later experiments verified the above results. It was found that on an average over 95 per cent. of the fat and also over 95 per cent. of the protein was digested, and more than 90 per cent. of the total energy is available for the body. They also show that cheese may serve as the principle source of protein and fuel in the body for a long time.

A comparison of the food value of cheese with that of other highly nitrogenous materials is of interest at this time. No kind of meat, except dried beef, carries such a large percentage of protein as cheese. Fresh beef, as purchased, has weight for weight, a little more than half the food value of cheese in either protein or fat, and the same is true of practically all other meats. Bacon or fat pork is an exception, but their food value is mostly in the fat. To put it another way—1 lb. of cheese has nearly the same food value as 2 lbs. of fresh beef or any other fresh meat as food. It is worth as much as, or more than, 1 lb. of ham, and is more digestible, and it is equal to 2 lbs. of eggs or 3 lbs. of fish.

It is estimated by the United States Department of Agriculture that the people of that country use about 175 lbs. of meat annually per head, besides fish and poultry, while the annual consumption of cheese is only about 4 lbs. per head. So it will be seen that there is room for a large increase in the consumption before it is equal to that of Britain.

PEPSIN IN PLACE OF RENNET FOR MAKING CHEDDAR CHEESE.

Owing to the scarcity and consequent high price being charged for rennet through the operation of regulations enforced under war conditions, it became evident that cheese-makers in this country would be faced with a very difficult problem with regard to supplies. Previous to the great European war nearly all the commercial rennet extract was made in Denmark from vells obtained principally from Russia, Austria, and Germany. After the outbreak of war, owing to the restrictions on trade, all these sources of supply were cut off and no others were developed to take their place. Instructions were issued by the Board of Trade to enable cheese-makers to prepare vells and manufacture their own rennet, as was done years ago before the commercial rennets were placed on the local market. In Canada this was also tried, but pronounced against by the Canadian Dairy Commissioner, on account of the risk that would result from the use of rennet of inferior quality. However, the difficulty of producing rennet of satisfactory quality locally should not be insuperable. In July, 1916, experiments were conducted at the Central Research Farm, Werribee, by Mr. Geo. Sawers and myself, to ascertain the result of substituting pepsin for rennet. There was no flake pepsin available in Melbourne at the time, only the powdered form of English manufacture, kindly supplied by the Gippsland and Northern Co-operative Selling Company. This we used until we obtained the flake pepsin. Subsequent developments indicated that as good results practically were obtained from one as the other, except that just four times the amount of powder was required to give the same results as one of flake. As soon as the strength was ascertained, the proceedings were as with the normal process of making Cheddar cheese. It remained then to see how it would mature. Some was exhibited at the Royal Agricultural Show the end of September. This appeared to be maturing normally. Others were cut from time to time with equally satisfactory results. The last was cut at eight months old, and the quality in every way was all that could be desired. Mr. Sawers has demonstrated the use of pepsin all over the State during the past season, and invariably with satisfactory results; in fact, not even experts could tell whether pepsin, rennet, or both, had been used. Van Slyke and Publow say—"Commercial pepsin has the following advantages over rennet extract:—

"1. It is more concentrated, and therefore more convenient and less expensive to ship.

"2. If kept dry, pepsin retains its strength indefinitely, while liquid rennet extract does not."

The quality of cheese made by use of pepsin does not appear to be inferior to that by the use of rennet.

Pepsin is the chief enzyme of the gastric juice in the stomach of man. It is also present in the stomach of many animals, and that used for cheese-making is chiefly obtained from the stomachs of sheep or pigs. In view of the enormously increased value of calves, this would be a great advantage from an economical point of view, as rennet is obtained

from the stomachs of young milk-fed calves, which ought to be reared to maturity. Moreover, the pepsin of the stomachs of practically all the sheep slaughtered in Australia and New Zealand at present is lost. The pepsin used so far for cheese-making is of American origin, although we obtained quite satisfactory results with an English powder pepsin of 1-2,500 strength, but we had to use four times the amount of the powder to give the same results as the flake.

When cheese is freshly made the casein is in an insoluble or indigestible form. The process of ripening consists in converting the insoluble casein into the soluble form. This process is not yet thoroughly understood, but much time and energy has been devoted to its investigation, and some points have been definitely decided. It was at one time thought that the ripening changes were due to bacterial action, but it was proved that in the absence of these organisms the casein was converted into the soluble form. It was proved that this was due to enzymes of rennet called rennin and pepsin. The difference between these is not rightly understood, in fact, some leading chemists consider that pepsin is the purified form of the ferment, and rennet is the crude form containing impurities. However, experiments have shown that there is something in rennet extract that is not present in commercial pepsin, but this is not necessary to the proper ripening of Cheddar cheese, for in the presence of acid, as is always the case in the manufacture of Cheddar cheese, the action of pepsin is able to account for all the changes observed in the case of rennet extract. Also commercial pepsin is a stronger digestive agent than rennet extract.

It will be seen, therefore, that there is no apparent reason why commercial pepsin should not give satisfactory results when used instead of rennet extract.

CHEESE OTHER THAN CHEDDAR.

As mentioned above, there are a great many different kinds of cheese made, but Cheddar is the most useful and universal. Even Holland, so long noted for its Gouda and Edam cheese, have lately produced a considerable amount of Cheddar. It has been suggested that some of the soldiers, while in England, should go to some of the dairy schools, and learn how to make Stilton, Gouda, Gruyere, and others, with the object of undertaking their manufacture on their return to this country. This would be largely a waste of time, as the demand for all cheese other than Cheddar is so small, owing to the population being comparatively small, that it would not be worth any one's while going to the expense of installing the necessary plant. The bulk of the Stilton consumed in New Zealand and Australia is the product of one small factory in New Zealand treating only about 600 gallons of milk per day. The leading cheese factory company in New Zealand decided to manufacture Stilton, and brought out an expert maker from England. The result was that, after making Stilton for a season, they could not find sale for it, although a good quality, and gave it up after a heavy monetary loss.

In this State some years ago a leading dairy firm employed an expert to make Gouda cheese, but their experience was no more satisfactory than that of the New Zealand company. When the population is many times what it is at present in Australia it may pay to undertake the manufacture of other kinds of cheese. In the meantime we would be better to devote our energies to an article for which we are sure of remunerative returns.

REPORT OF CONFERENCE RE DISEASE ATTACKING PLANE TREES.*

A Conference of experts, convened by the Hon. the Minister of Lands, to discuss the matter of the disease that has lately attacked the Plane trees in various parts of the State, was held at the Board Room of the Lands Department on 21st February, 1917.

The response to the invitations issued by the Minister was most satisfactory, representatives of over thirty municipalities throughout the State, most of whom were practical horticulturists, being in attendance, in addition to officers of various Government Departments who are specialists in the classification, cultivation, and health of trees and other vegetation.

Mr. Hutchinson, in opening the Conference, expressed his pleasure at the very practical manner in which the various bodies interested had replied to his note, and his belief that the deliberations of the Conference would be productive of benefit by recommending means for combating the new and destructive disease—*Glœosporium nervisequum*—that was affecting Plane trees, and was causing much anxiety to all lovers of trees. He referred to the damage already caused by the disease in certain places, and considered that early and very definite action should be taken to check its ravages and spread. As President of the Board of Land and Works, Mr. Hutchinson thought the matter was sufficiently important to warrant his invitation to the Conference, and consideration of this very serious trouble, to municipalities and other bodies who were interested in the cultivation of trees.

Mr. J. Harris, Chairman of the Metropolitan Parks and Gardens Committee, was elected chairman of the Conference, on the motion of the Hon. the Minister.

Mr. J. M. Reed, Secretary for Lands, explained that he and the Curator of the Botanic Gardens, in conjunction with Mr. W. Laidlaw, Biologist, and Mr. C. C. Brittlebank, Vegetable Pathologist to the Department of Agriculture, had discussed the matter in order to be able to submit something definite on which to base the Conference, and secure the best experience and knowledge bearing on the disease, and the most effective means and remedies for its control. He requested Mr. Cronin to act as departmental secretary to the Conference, and also expressed the belief that the capacity of the representatives present was such that means would be evolved to cope with the trouble.

The Chairman stated that the Plane tree was undoubtedly one of the finest trees known, and was essentially a suitable tree for planting in streets.

Letters were read from Rear-Admiral Bridges, who has had experience of the disease, and from Mr. J. Blackburn, late of the Department of Forests, and Mr. T. W. Pockett, Curator of Malvern Gardens, respecting the probable causes of the disease.

Messrs. Cronin, Laidlaw, Brittlebank, and Professor Ewart explained their knowledge of the disease, its nature and history, its ramifications throughout Victoria, and its sudden appearance in the

* Issued by the Lands Department and reprinted here by permission of the Secretary for Lands.

metropolitan district during the current season. It was definitely stated that the disease was due to the fungus named by the Minister of Lands, and that, although affected specimens had been received at the Science Branch of the Department of Agriculture from country places for several years past, not one case had been reported from Melbourne or its environs prior to this season.

Various representatives spoke on the disease, and also on the identity of the species of Platanus (the Plane) generally grown in Victoria for street planting.

Branch showing affected shoot. Such branches should be entirely removed when the winter pruning is being carried out.

It was apparent that the disease was unknown to most of the speakers, ordinary ill-effects, due to seasonal influences, bad nutrition, &c., &c., being described as evidence of its existence, and suggestions, based on such belief, were made for its control.

Mr. J. H. Upham, Curator of Castlemaine Parks and Gardens, combated many of these statements and suggestions, and produced

Young tree seriously affected with the disease. All the branches should be cut hard back to the main stem.

specimens from trees growing under varying conditions of soil and situation at Castlemaine that were equally affected. These specimens

were subsequently submittel to microscopic examination, and were definitely found to be diseased. Mr. W. O. Allan, of Ballarat, agreed with Mr. Upham. The trees at Ballarat were badly attacked under most diverse conditions.

Various delegates considered that the Plane tree had been planted too freely in the past, and, in many instances, in soils and situations unsuitable for its healthy development. It was, however, generally agreed that the Plane was a most suitable street tree, and that it was specially valuable where the atmosphere was smoke laden.

The action of the Minister of Lands in calling the representatives together to discuss the matter in question was cordially approved. The hope was freely expressed that a conference of tree and park managers would be held annually to consider questions bearing on the selection, planting, and management of trees suitable for street and park decoration. It was pointed out that large sums of money had been spent in tree culture, and would need to be spent in future in caring for the trees already planted and for fresh plantings, and that meetings such as the present one would tend to more satisfactory results generally henceforth.

The Chairman commented on the various statements of the scientific and lay members of the Conference, and submitted the following resolution:—

> That this thoroughly representative meeting of curators and other gentlemen, representing over thirty municipalities in Victoria, view with much concern the spread of the fungoid disease of the Plane tree (scientifically *Glœosporium nervisequum* on leaf, *Myxosporum valsoideum* on branch). That it is imperative that remedial measures be taken early to check its ravages; these to be effected by systematic pruning of diseased trees by competent men, and by spraying the trees under the advice of officers of the Department of Agriculture.

This resolution was seconded by Mr. A. Rumball, of Bendigo, and carried unanimously.

Other resolutions that were carried were—

> That this Conference recommends that in future the Plane tree should only be planted in soils and situations that are favorable to its healthy development.
>
> That the matter of calling an annual conference be left in the hands of the Hon. the Minister of Lands, the Secretary for Lands, and the Curator of the Melbourne Botanic Gardens.

A hearty vote of thanks to the Minister of Lands for his action in calling the Conference was carried unanimously.

A vote of thanks to the Chairman terminated the proceedings.

Recommendations made regarding the treatment of affected trees were—

1. That all diseased trees be heavily pruned early in winter, and all affected shoots and branches be burned forthwith.

2. That leaves from such trees should be collected, as soon as possible after falling, and burned. As the spread of the disease is most probable through the agency of affected leaves, this recommendation is most important.
3. That the trees, after being pruned, should be sprayed with Bordeaux mixture during winter, and again when growth begins in spring.
4. That it is essential for the control of this and other diseases of trees that adequate spraying machinery should be provided for the purpose.
5. That in any place where the tips of or shoots or branches of Plane trees are dying, specimens should be submitted, for examination, to the Science Branch, Department of Agriculture, Melbourne.
6. That all nursery trees be carefully inspected prior to the planting season.

REMINDERS FOR AUGUST.

Live Stock.

HORSES.—Those stabled can be fed liberally. Those doing fast or heavy work should be clipped; if not wholly, then trace high. Those not rugged on coming into the stable at night should be wiped down and in half an-hour's time rugged or covered with bags until the coat is dry. Old horses and weaned foals should be given crushed oats. Grass-fed working horses should be given hay or straw, if there is no old grass, to counteract the purging effects of the young growth. Old and badly-conditioned horses should be given some boiled barley.

CATTLE.—Cows should still be rugged, but coverings should be removed frequently, in order to enable the animal to get rid of the old coat; or, better still, a good curry-combing may be given. Continue hay or straw. Look up treatment for milk fever in *Year-Book of Agriculture*, 1905, and treat cattle accordingly. Give calves a good warm dry shed. Give the milk to young calves at blood heat. Have feeding troughs or buckets clean. Don't over-feed. Feed regularly with regard to quantity and time. Provide a good grass run, or fine hay or crushed oats in a box or trough. Give a cupful of limewater per calf per day in the milk. The problem with many at the present time is how to rear calves without milk. This can be done very well by starting them on new milk for a fortnight, and then gradually substituting the milk with one of the calf meals on the market. To these it would be advisable to add two or three tablespoonfuls of cod liver oil. The following meal is in general use in Ireland:—Two parts, by weight, of oatmeal, 2 parts maize meal, 1 part pure ground linseed, all finely ground. Scald with boiling water, and allow to stand for twelve hours. Start with new milk, then gradually substitute skim and ¼ lb. daily of the meal mixture per head per day, gradually increasing to 1 lb. or more. In a month milk may be dispensed with altogether. The crushed oats, fed dry, have been found to give excellent results.

PIGS.—Supply plenty of bedding in warm well-ventilated sties. Keep sties clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. If pigs are lousy dress with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect sties. Considering the present high price of pork, there should be a good margin of profit

in fattening pigs. Worms are very prevalent at present, and may be treated by giving 2 to 10 grains of Santonin in form of pill, or from half to one teaspoonful of oil of turpentine in milk or castor oil.

SHEEP.—Decide on the breed and number of rams required for the coming season. Place orders as soon as possible, for breeders can then give better satisfaction and allot preference to the earlier applications. The result of mating should be given most careful consideration from a wool point of view. Evidence points to an extreme shortage of good merino and fine cross-bred wool for years to come. At the same time, a steadily increasing demand has set in for materials manufactured from these finer grades. The world's civilian requirements must be met, and for flannels and finer materials for temperate and cold climates these are indispensable. After all coarse wools have a limited use. Cull stud ewes carefully, especially merinoes, consider form as well as evenness of covering and style of wool. Discard for thin fribby forearms, for coarse common thighs, for mushy wasty undercovering, inferior patches across the shoulders, common and short between the hip bones. Individual merit must be considered carefully, pedigree alone is not sufficient.

POULTRY.—Yards should be turned over with a spade or fork, and sown down with rape or barley. Keep the breeders busy—straw litter with a little grain scattered about will make them exercise. Overhaul incubators; see that the capsule of thermostat acts properly; thoroughly clean lamps, egg drawers, and chimneys. Test machine for two days before putting eggs in. It is also advisable to have thermometer tested. When additional incubators are required, it is more satisfactory to keep to the one make.

Cultivation.

FARM.—Second fallow where necessary for summer crops. If required, roll or harrow crops. Plant very early potatoes in forward districts. Sow mangolds. Apply slow-acting fertilizers, such as blood and bone manures, for maize.

ORCHARD.—Complete planting and pruning of deciduous trees. Watch for peach aphis, and spray with tobacco solution, if present. Prepare for planting citrus trees. Spray for woolly aphis with lime sulphur spray.

FLOWER GARDEN.—Finish digging and pruning of roses, &c. Leave pruning of shrubs till after flowering. Keep weeds in check; weed out seed beds. Divide and plant out all herbaceous plants, such as phlox, delphiniums, rudbeckia, &c. Plant out gladioli. Complete planting of shrubs. Mulch young plants.

VEGETABLE GARDEN.—Top-dress asparagus beds; plant new asparagus plots. Plant herb divisions, and potatoes. Sow cabbage, cauliflower, peas, carrots, beans, radish, and lettuce seeds. Sow tomato seeds in a hot frame. Finish digging.

VINEYARD.—August is the best month for planting vines (grafted or ungrafted). This should be actively proceeded with and completed before end of month. Scions for field grafting may still be preserved as detailed last month, or better still by placing them in cool storage. They should all be removed from vines before end of month, at latest. Conclude pruning and tie down rods. Where black spot has been prevalent, apply 1st acid iron sulphate treatment. In view of the serious damage caused by this fungus in many districts last summer careful attention to preventive treatment is emphatically urged (see article in current issue).

Cellar.—Rack again, towards end of month, wines which have as yet only been once racked (spring racking). Fill up regularly all unfortified wines. Clean up generally in cellar and whitewash walls, woodwork, &c.

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TREATMENT OF PASTURES.

PREVENTION OF RICKETS, CRIPPLES, AND PARALYSIS.

Increase of Production.

By E. W. Murphy, Dairy Supervisor.

Rural matters are receiving special attention at the present juncture in connexion with war problems. Mr. Lloyd George has emphasized the need of increasing production, and E. J. Russell, D.Sc., Director of the Rothamstead Experimental Station, in a recent manual urging the increased use of fertilizers for higher crop production, in the last sentence, says:—"But, above all, try and improve the pastures."

Experiments at the Rutherglen State Experimental Farm, conducted by Mr. A. E. V. Richardson, M.A., B.Sc., have demonstrated the great value of lime and phosphatic manure for top-dressing grass lands. By means of moderate dressings, the carrying capacity was more than doubled, and, with better attention to sub-division, so as to be able to intelligently control the grazing, much could be done over large areas in this State, by following the example. Some grasses will stand a fair amount of close eating, whilst others, such as prairie-grass and cow-grass, will not stand heavy stocking. In Gippsland, I have frequently noticed that a fence seemed to divide good land from bad, yet the difference was entirely due to one being a fattening paddock, and the other running milch cows. If the pasture is continually eaten closely, the root system is weakened, and more exposed to extremes of climate, but occasional heavy stocking is an advantage, and helps to keep down undesirable growths.

Scientific research has shown that fresh succulent foods contain "protective substances" or vitamines, which are essential to life. In the dry scanty herbage of impoverished soils, during drought times, there is a paucity of these "protective substances," and a marked deficiency of the necessary minerals, which recent physiological investigations have shown to be so essential to life. Hilda Kincaid, M.Sc., in 1910, did research work, under the guidance of Professor Osborne, on the "Biochemical

Significance of Phosphorus," and she showed the remarkably low percentage of the important minerals in Victorian grasses, such as tussocky and kangaroo grasses, making it hard to understand how cattle could live on such fodders alone. The Department of Agriculture of New South Wales, in a *Science Bulletin*, issued in 1914, gives the results of considerable research work regarding the soils and grasses of the areas where bone-chewing is prevalent, and where "stiffness," and eventually death, often results among the milking cows and young growing cattle, the herbage there being remarkably deficient of phosphoric acid, lime, and potash. In New Zealand the administration of a syrup of iron and phosphorus to cows sick with "bush sickness" gave good results, and a lick made up of lime, salt, and perchloride of iron was found to be very beneficial (*vide* New Zealand *Journal of Agriculture*, November, 1915). The use of lime (20), salt (200), sulphate of iron (10), sulphur (5), and gentian (2) as a lick has a marked good effect on the health of sheep in the Balmoral district. Bone-meal and other forms of phosphate of lime, with other minerals, are used in various parts of Victoria, with varying degrees of success, when a cow is troubled with "stiffness" or "rickets." In the different forms of paralysis and impaction, called by the various names of "Winton disease," "Yambuk disease," cripples, &c., in Victoria, "Midland disease" in Tasmania, there is the one constant factor of low content of phosphoric acid in the herbage, and in such case the plant is ill nourished, and probably deficient in the vitamines. It is therefore imperative to feed the pasture grasses in order to properly feed and nourish our stock, and, moreover, the absence of lime and potash renders the herbage more liable to the attacks of moulds, fungi, &c., which are harmful to the cattle.

Most stockmen believe that impaction is due to tough, dry, indigestible fodder, in a mechanical sense, and some know that the quality of the water which the cattle have to drink may be directly or indirectly the cause, but very few realize that, even though the animal is in good condition, it may suffer from disordered nerves due to mal-nutrition, through a deficiency in the soil.

Professor Osborne, writing in the *Scientific Australian* in December, 1915, says:—

"The animal body has no capacity for organic synthesis; all the chemical principles required have to be derived from the vegetable kingdom. Animals have no means of building up complicated chemical compounds. Every organic radicle necessary has to be obtained from the vegetable food."

I pioneered in Gippsland for a number of years, and was well aware that there was a shortage of phosphate of lime in that part of Victoria, and the potash is probably deficient at the surface, or locked up, and the eating of the bracken (it being high in potash) is very likely associated with this fact. The bone-chewing habit is also associated with this lack of minerals in the herbage.

Experience in connexion with the mortality of cows on several holdings on the Mornington Peninsula is instructive, and helpful towards a clearer understanding of the benefits of attending to the pastures.

To an old pioneer of the peninsular, I am indebted for first-hand information. Mr. Felix Foster came to Brighton in 1844. Later on, he took up land near Somerville, alongside Captain Baxter, who had settled there in 1840. Mr. Foster says that Captain Baxter often remarked that

"when he first saw the district from the south-east side of Mount Eliza, it seemed to be a grazier's paradise." Now, if you look from the same point over the old homestead, it looks like a grazier's "tophet," and the "sins of omission" have brought the scourge of "cripples." Had a better observance of the simple natural laws been followed, nature would have continued to hold out her "horn of plenty." Visiting the homestead in February, 1916, I was informed by the Misses Baxter that numbers of their cattle had died, although there was plenty of kangaroo grass in the paddocks. Similar changes have taken place in the Hamilton district, and present conditions are very different from what Major Mitchell was so delighted with when he called it "Australia Felix."

About Mornington, in the early days, the hollows among the lightwoods were covered with a carpet of grasses, on which the cattle thrived, and they would not stay on the messmate or peppermint country, but during wet periods they chose the dry ground among the native oaks. Cattle have a wonderful sense for locating the special substances which they need, and of selecting the food richest in the required elements, and sheep have a decided advantage over cattle in being able to eat the short and sweeter grasses. Thus as the district became fenced in, and the stock had much less choice of pasture, the finer and sweeter herbage became eaten out, and bayonet grass, thatch grass, sword grass, and manuka took their places. Such growths indicate a sour, hungry, and toxic condition of soil. Bone-chewing, with its attendant risks, became prevalent, and paralysis, with sudden death, often occurred. Of late years, there has been some improvement, due entirely to better management. Phosphatic fertilizers are being used more freely, and catch crops grown and eaten off with sheep, thus improving the soil in texture as well as in plant food.

Mr. Richard Grindal, who was trained as a farmer on a Westmoreland farm, secured 100 acres of poor land, in 1872, near Somerville, and though cattle would not thrive on the place at first, he did not lose many, and by dint of labour and sound practice, he converted the little place into good healthy fields. His system was to break up a few acres each year, and grow two crops on it, one of oats and one of potatoes, using 2 cwt. of Malden Island phosphate of lime per acre, and then sow down in grass, giving it a top dressing of the manure of about 2 cwt. per acre. After being in grass for about four years the course was repeated. Very careful attention was given to conserving the farmyard manure, and particularly the urine, which was caught in tanks, and carted on to the fields. Lime was carted from Dromana, and little paralysis ever troubled the cattle, and none whatever since the first few years. The example, however, was not followed by his neighbours, and the butter factory which had been established was forced to close up, as very few cows were left in the district. Mr. Grindal has lived a long and useful life, which is now in its evening, and the record of how he made the blades of grass grow, and the land sweet, is a very forceful lesson to the Gippslanders and the western-plainsmen, who, having depleted their soil, are losing their cows.

Adjoining Mr. Grindal's place is "Spring Farm," occupied by Messrs. E. Jones and Sons, and the history of this farm is very striking evidence of the wisdom of feeding the pasture lands, as against depending on licks, or dosing with minerals when the cattle have become unthrifty. For a number of years, milking cows could not be kept on the

farm. High-priced cows were bought at Dandenong, and in about two months they would suddenly collapse and die. Paralysis of the throat, dribbling from mouth, becoming groggy, and, later on, death, without any sign of a struggle, or of pain—such was a very frequent and disheartening experience. Manure was being used for the growing of crops, but eventually it was decided to top-dress with bonemeal, as superphos-

No. 1.—Showing healthy land on the left that has been manured with the bones of animals that die on the land towards the right.

No. 2.—Paddock with abundance of grass upon which cattle die.

phate was not found to be satisfactory, because the benefit was only temporary. The purchased bone-meal was also very unsatisfactory, being adulterated with seashells, and hoof filings. A bone-crusher was purchased, and bonemeal was made on the farm, and this has been their "sheet anchor." No sign of cripples or paralysis has been seen on "Spring Farm" for over fourteen years.

A series of photographs of this farm, taken in August of last year, are instructive. No. 1 view shows a corner of Mr. Jones' back paddock, where the grass is well eaten, short, and wholesome on the left of the fence, and on the right we can see in the neighbouring paddock the long growth of thatch grass, kangaroo grass, tussock grass, manuka, and wattles, and small native oaks. On this paddock cattle will not thrive, and, if kept there, eventually die.

No. 3.—Sweet pasture, well grazed, and supporting cattle.

No. 4.—Virgin land improved by top dressing only.

The picture No. 2 is a more extensive view of the worthless grasses. The quantity is there, but the quality is very unsatisfactory, and the special consideration that we are now emphasizing is not the protein and carbo-hydrate ratio, but the ash or mineral elements which hitherto have been almost neglected, and the importance of which these pictures and the history of this farm demonstrates.

No. 3 is a view across Mr. Jones' back paddock. There are some bunches of bayonet grass, which the cattle keep cropped, when there are

but few. The spring was not very advanced when the photograph was taken, but there was an attractive appearance about the fields, as compared with most of the neighbourhood. This field, as shown, had had 2 cwt. of bonemeal top dressing per acre, and the droppings of the cattle which were well fed on fodder grown on well manured ground of the farm.

The illustration No. 4 gives a picture of a very fine paddock of native grass, with some rye grass, fog, and rib grass, through it. Mr. Jones, in early days, was constantly sowing English grasses, but they would not hold, and at length he told the sons to change their plans, and to try to strengthen the native grasses that would grow, and now, on some of the fields that have been tilled, and then sown in grass, there is a beautiful sheen of rye grass. This paddock has never been broken up, and here there is a very thick mat of various grasses, though mostly native, on which stock thrive splendidly, and recently, sheep from "Spring Farm" established a record in prices at the Mornington saleyards.

No. 5.—Dairy Cattle in the best of health.

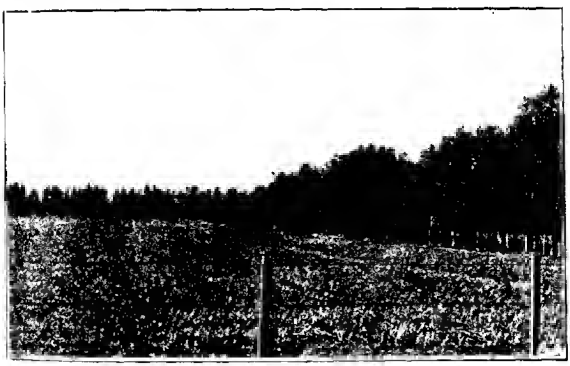
Our fifth picture gives an idea of the cows. They are of good dairy type, and they have the "bloom" of health, which has been the reward to the owner for his careful and persistent efforts to build up the soil, and beautify his farm with rich green grass and splendid shelter trees. Years back, when the cows were sometimes stricken with paralysis, and died suddenly, they used to be in fair condition, but they did not have the "bloom" that these cattle show, and I would just here revert to the words of Mr. Felix Foster regarding some opinions that were held by some of the old stockmen. He says that he heard at different times the belief expressed that the sheen, or shiny part of the grass, had some special property in relation to health, and in that there seems to have been a hint of the vitamines.

No. 6 is a small field near the homestead. Note that the cow and horse droppings have just been spread. At the time of the visit, Mr. Jones was at work here spreading the dung with a special tool that he had made. He contends that too much dung on one spot is harmful, as it kills the grass, harbours vermin, and induces a rank tuft later on. On this plot the grass is a splendid colour, fine, sweet, and closely cropped,

and the practice of spreading the manure is one that I think a great many could adopt with advantage.

In some of the paddocks kangaroo grass and tussocky grass are still rather much in evidence, and even where they become long and stale, there is a dense mat of finer grasses, no bare spots appearing at all. On these parts, there has recently been a second application of bonemeal, which makes a total of 4 cwt. of top dressing per acre to land that has never been ploughed. There is a deficiency of clovers in this herbage,

No. 6.—Closely cropped sweet pasture.



No. 7.—Cultivation and Shelter.

and from the point of view of production the clovers need to be encouraged by the use of lime carbonate, of which Mr. Jones has not used enough in treating his pastures.

No. 7 is a view of a beautiful row of gums and wattles, along a pathway from the homestead to the dam, which supplies water by gravitation to the yards and sheds, &c. The pines in the distance are along the main roadway, and they extend over the whole front, and join on to Mr. Grindal's. This photograph shows stubble land, from which a heavy crop of oats was harvested, bonemeal again doing good service. About

the house are many splendid pines, giving shelter, and No. 8 shows the calf paddock with a good sward of closely cropped grass.

Heavy crops of maize are grown on the farm, and there are two fine 45-ton brick silos, close by the barn and cow-shed. No exact records have been kept, but the yields have been very good, and there is always full and plenty. A fine oil engine gives the power for the bone-crusher, corn-mill, chaff-cutter, &c. A very attractive home, surrounded by giant pines, and a beautiful garden, is to be seen by the passer-by. Mr. Jones

No. 8.—Calf Paddock with good grass and shelter.

No. 9.—Virgin land, broken up after burning.

was a sea-faring man, but heard the cry "Back to the land." He has by thrift and hard labour transformed this place from a wild, unprofitable condition to smiling pastures, and a most attractive home. The system of farming has been mostly left to the sons, and the father formerly "kept the pot bubbling" by taking big contracts, and exercising his undoubted talents of a constructive nature towards increasing the income, but now, and for many years past, the farm has been rather more than self-supporting. The last illustration (No. 9) was taken on property adjoining "Spring Farm," and shows virgin land broken up after burning.

APPLE CULTURE IN VICTORIA.

By J. Farrell, Orchard Supervisor.

(Continued from page 403.)

Distinct Variety Characteristics.

As the different varieties of apples are evolved, whether as the result of self or cross-fertilization, on each new variety is stamped the imprint of originality and individuality. This, Nature does by bestowing on each its respective and distinct characteristics, viz., class of wood, the tree's growth and fruiting habit, as well as the peculiarities relating to the size, shape, colour, quality, and quantity of its fruit.

Although the fruit of varieties produced from "sports" may vary in shape, size, colour, quantity, &c., from that of the parent trees, yet their wood usually retains the characteristics of the original varieties.

To select varieties of the highest commercial value, and, as in pre-war times, those best fitted for export oversea, the planter should choose varieties individually endowed with suitable combinations of characteristics of the highest order. He should also know that the varieties so selected would thrive on his land and under the climatic conditions obtaining locally. Considerable progress in this regard has been made, particularly during recent years, owing to investigations made by fruit-growers, by the experts, and by the Inter-State Pomological Committee.

Fruit Nomenclature.

To secure uniformity of fruit nomenclature, and particularly to facilitate the better management of the export trade of the various States, it was found necessary, owing to the various names and synonyms given to some of the old apple varieties, to rename them.

The task of naming new varieties as they are produced and brought under notice, as well as the renaming of old ones where this is considered desirable, is also performed by the Pomological Committee. The name selected for adoption in each case is that which, in the opinion of the nomenclators, best suits the variety under the conditions mentioned above.

Identification of the Fruit.

Typical apples of the many varieties have their distinct characteristics, viz., in relation to size, shape, and colour, by which their identification is usually established.

Plates 112 and 113 give photographic illustrations of twelve popular varieties, and these are fairly good illustrations of each the names of which are given in the explanation of the plates.

Identification by Means of the Wood and Leaves.

The many peculiarities of their respective wood and leaves, when understood, also enable the student of pomology to identify the varieties by this means.

Plate 114 shows typical yearling's wood of the twelve varieties appearing in Plates 112 and 113. These specimens were selected to represent the various types mostly on account of their relative strengths, habits of growth, and bud formation. When compared with each other it

will be observed that they vary from the straight wood of the London Pippin (*a*) with its small and closely set leaf buds, through the various types, to the long and partly spiral bending internodes of the King David wood (*f*).

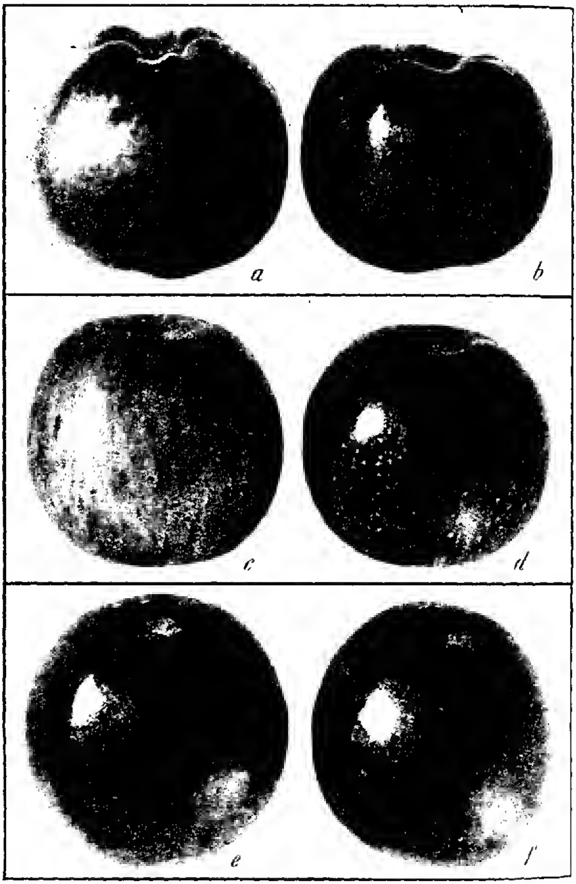


Plate 112.

Six Varieties of Apples.

a London Pippin.
b Moss' Incomparable.
c Statesman.
d Baldwin.
e King David
f Jonathan.

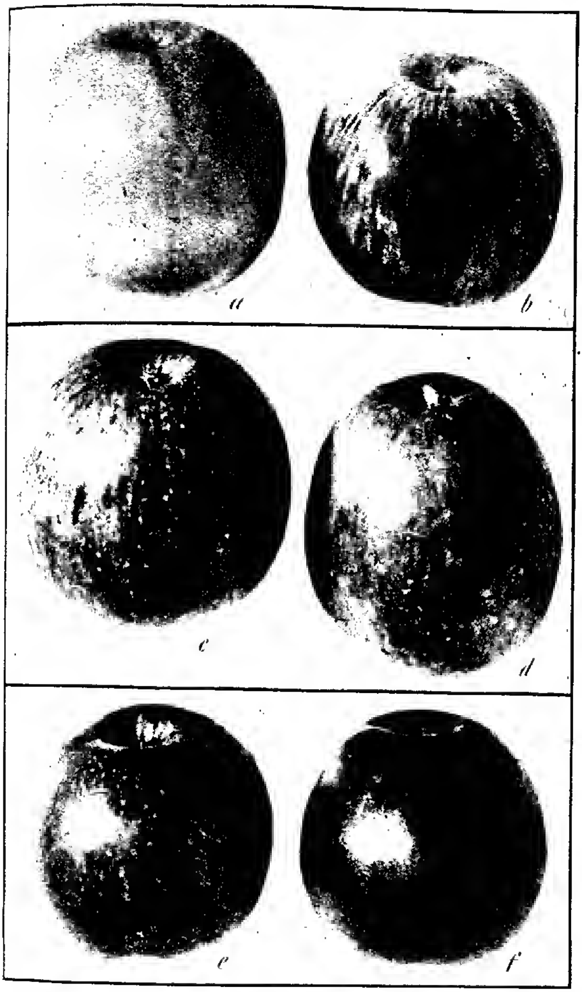


Plate 113.

Six Varieties of Apples.

a Stone Pippin.
b Pomme de Neige.
c Rome Beauty.
d Esopus Spitzenberg.
e Yates.
f Rokewood.

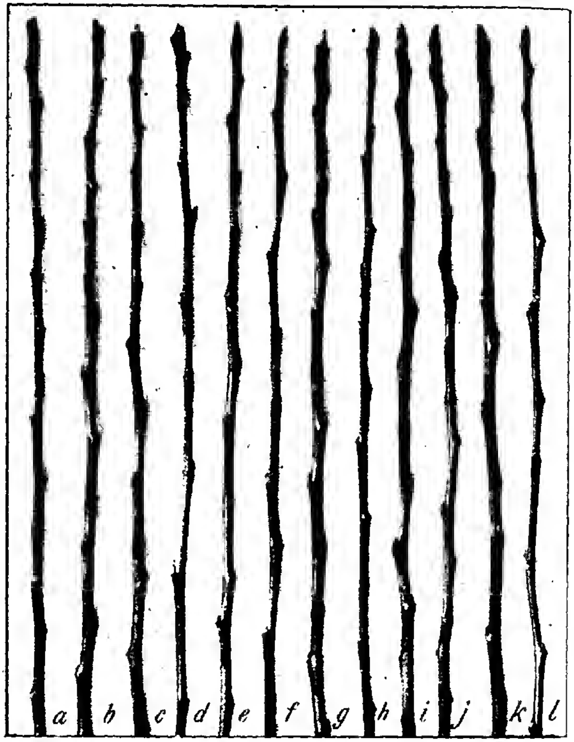


Plate 114.

Yearling Growths of same Twelve Varieties.

a	London Pippin.	*g*	Stone Pippin.
b	Statesman.	*h*	Esopus Spitzenberg.
c	Yates.	*i*	Moss' Incomparable.
d	Jonathan.	*j*	Baldwin.
e	Rome Beauty.	*k*	Rokewood.
f	Pomme de Neige.	*l*	King David.

With regard to the leaves it may be stated that, although typical specimens are usually produced on the young wood, irregular types are mostly found on the older growths. Consequently, these organs are not of equal value with the fruit and young wood as a means to variety identification, and for this purpose the fruit buds and bark also, on account of their respective features, are of considerable assistance.

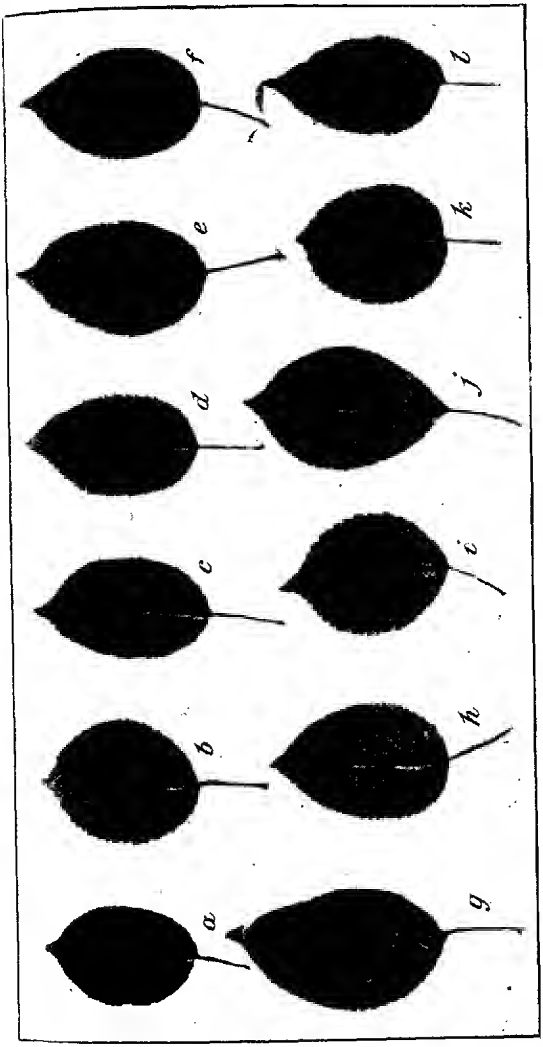


Plate 115.

Leaves of same Twelve Varieties.

a London Pippin. *b* Statesman. *c* Yates. *d* Jonathan. *e* Rome Beauty. *f* Pomme de Neige.
g Stone Pippin. *h* Esopus Spitzenberg. *i* Moss' Incomparable. *j* Baldwin. *k* Rokewood. *l* King David.

Further comment on the leaves is considered unnecessary as the illustrations in Plate 115 speak for themselves. These are about half natural size, and the names of the varieties are given below the plate.

Variety Identification by Means of the Flower.

While engaged in the study of pomological nomenclature and variety-distinguishing characteristics during the necessarily long periods of investigation, the writer discovered that the respective varieties can be identified by means of their blossoms. The florets of a variety like its fruits, wood growths, leaves, &c., may vary somewhat, and in some sorts this is more apparent than in others. Nevertheless, when typical specimens are procured they afford an accurate means to correct identification.

Photographic illustrations of vertical sections of the blooms of 216 varieties of apple trees growing in Victoria are given in Plates 117 to 122 inclusive, and the names of the 36 varieties contained in each plate are given below it.

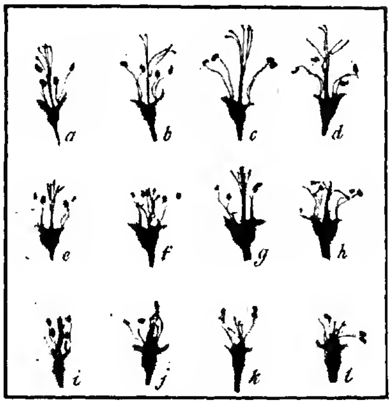


Plate 116.

Four stages of the blossom of the Rokewood variety (*a, b, c, d*). Morgan's Seedling (*e, f, g, h*). Sturmer Pippin (*i, j, k, l*).

No two varieties produce blooms alike, the main differences in their botanical construction being the relative length of the unions of the pistil divisions above the nectary, the relative length of the pistil divisions above the union, and the relative length of the stamens to their own pistil. Typical minor variety differences may also be observed in the stigmas, anthers, sepals, and petals.

On account of the main differences in their structural formation the blossoms of the several varieties may be divided into three classes, viz., those with long, medium, or short pistil unions respectively, allowing the subdivisions to be arranged according to the minor differences in their botanical construction.

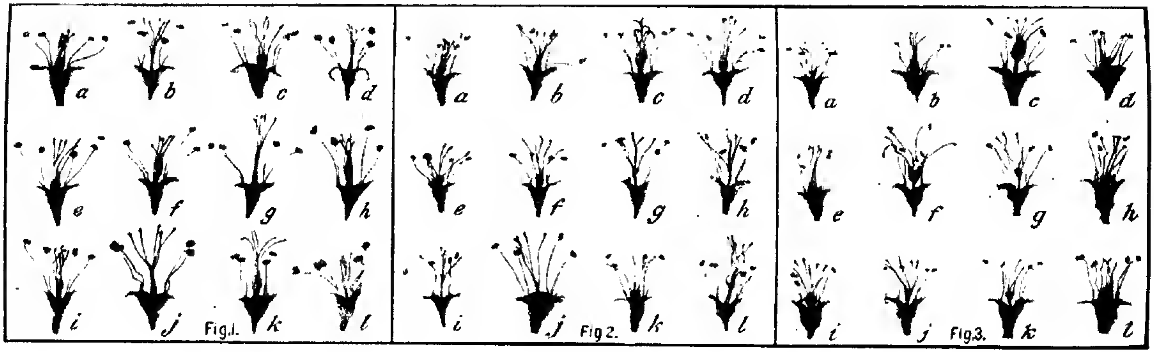


Plate 117.

Fig. 1.

a Jonathan.
b Statesman.
c Rymer.
d Shoreland Queen.
e Yates.
f Red Astrachan.
g Rokewood.
h Stewart's.
i Dunn's Seedling.
j Reinette de Canada.
k Smith's Seedling.
l Maiden's Blush.

Fig. 2.

a Lord Wolseley.
b Early Margaret.
c Ben Davis.
d Gravenstien.
e Shepherds' Perfection.
f Green Alfriston.
g Morgan's Seedling.
h Magg's Seedling.
i Scarlet Nonpariel.
j Irish Peach.
k Prince Albert.
l Nickajack.

Fig. 3.

a Adams' Pearmain.
b Prince Bismarck.
c Dumelow's Seedling.
d Winter Majetin.
e Northern Spy.
f Cheltenham Pippin.
g Prince of Pippins.
h Cox's Orange Pippin.
i Twenty Ounce.
j Cleopatra.
k Esopus Spitzenborg.
l Ribston.

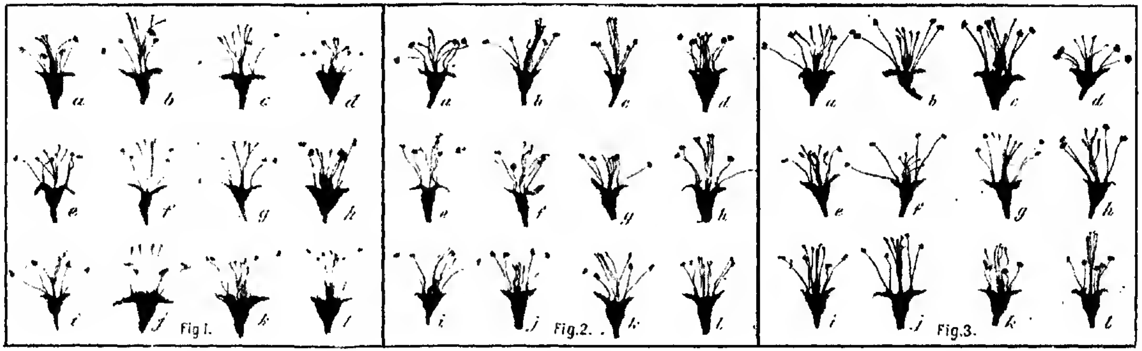


Plate 118.

Fig. 1.

a King David.
b Pomme de Neige.
c Dougherty.
d Wining's Late Red.
e Williams' Favourite.
f Munroe's Favourite.
g Senator.
h Delicious.
i Shockley.
j London Pippin.
k Fillbasket.
l John Toon

Fig. 2.

a Mellon's Seedling.
b French Crab.
c Rome Beauty.
d Buncombe.
e Autumn Pearmain.
f Missouri Pippin
g Emperor Alexander.
h Kirk's Admirable.
i Red Cluster.
j Sturmer Pippin.
k Lady Hopetoun.
l Stone Pippin

Fig. 3.

a Grand Duke Constantine.
b Gooseberry Pippin.
c Kentucky Redstreak.
d Newtown Pippin.
e Beauty of Bath.
f Blondin.
g Devonshire Quarrenden.
h Lord Lennox.
i Scarlet Pearmain.
j King of Pippins.
k Cellini.
l Mr. Gladstone.

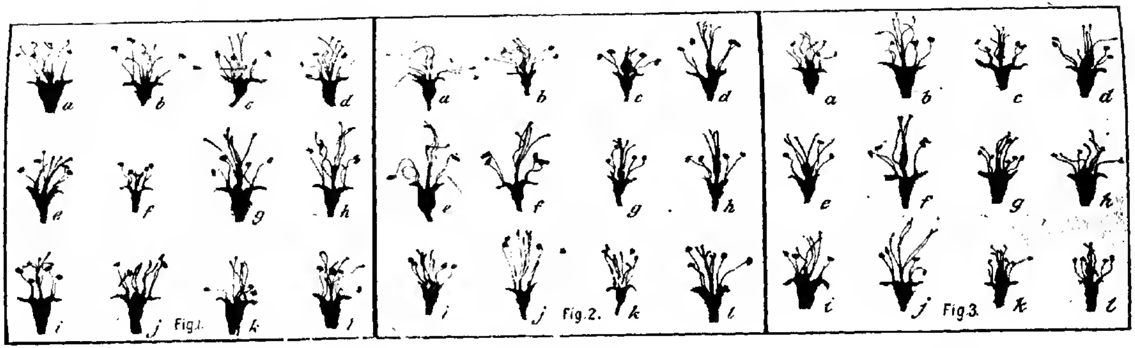


Plate 119.

Fig. 1.

- *a* General Carrington.
- *b* Stayman Winesap.
- *c* Dr. Hogg.
- *d* Carolina Red June.
- *e* Wellington.
- *f* Lord Suffield.
- *g* Lord Carrington.
- *h* Prince Edward.
- *i* Golden Pearmain.
- *j* Lucomb's Seedling.
- *k* Sam Young.
- *l* St. Martin's.

Fig. 2.

- *a* Coral.
- *b* Worcester Pearmain.
- *c* Kooroochiang.
- *d* Red Streak.
- *e* Frampton.
- *f* Emperor Alexander White.
- *g* Bielo Borodawka.
- *h* Gascoigne's Scarlet.
- *i* Foxwhelp.
- *j* Malus Floribunda.
- *k* Margil.
- *l* Waverley.

Fig. 3.

- *a* Gloria Mundi.
- *b* Red Beitgheimer.
- *c* William Anderson.
- *d* Paradise.
- *e* Fall Beauty.
- *f* Ballarat Seedling.
- *g* James Grieve.
- *h* Reine Louis d'Danemark.
- *i* Gravenstein Rouge.
- *j* Cardinal.
- *k* Kingston Black.
- *l* Dartmouth.

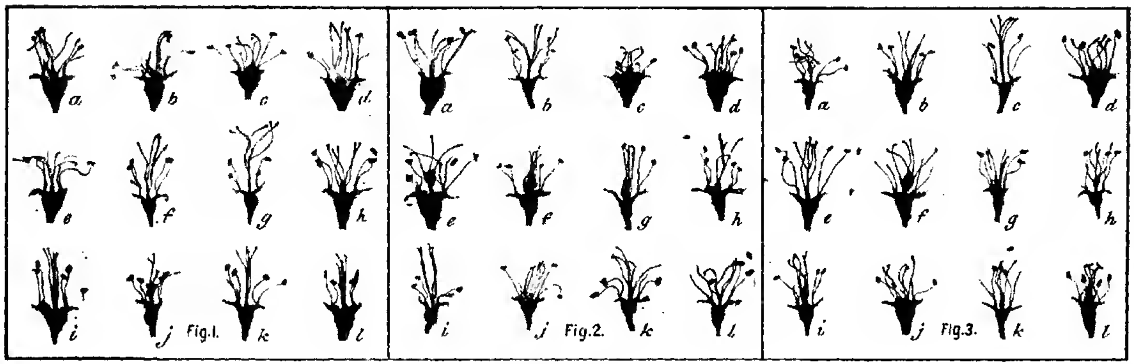


Plate 120.

Fig. 1.

a Red Majestic.
b Sharp's Late Red.
c Champion.
d Barry.
e Cole's Rymer.
f Prizetaker.
g Granny Smith.
h Belle de Pontoise.
i Skyrme's Kernel.
j Lanwood's Everlasting.
k Cowarne Red.
l Hoover.

Fig. 2.

a Golden Russet.
b Stansill.
c Summer King.
d Albury Park Nonsuch.
e Early Richmond.
f Sharp's Monarch.
g Taunton.
h Jupp's Surprise.
i Grand Sultan.
j Brownlee's Russet.
k Boston Russet.
l Santa Clara King.

Fig. 3.

a Loy.
b Newman's Seedling.
c Pioneer.
d Chicago.
e Orator.
f Foster.
g Lever.
h Moore's Extra.
i Allsopp's Beauty.
j Moss' Incomparable.
k Late Wine.
l Hoary Morning.

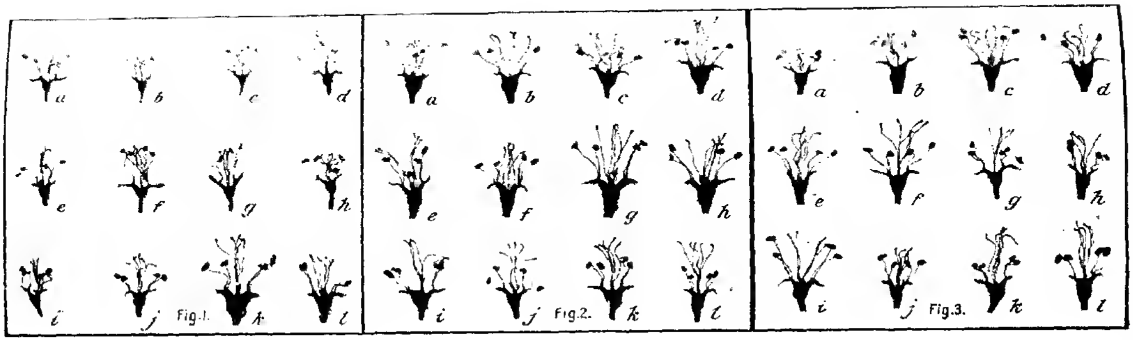


Plate 121.

Fig. 1.

a Baumann's Red Winter Reinette.
b Jubilee.
c Keswick Codlin.
d Thompson's Long Keeper.
e Mona Hay.
f Malus Communis Aurea.
g Trivett's Seedling.
h McMahon's White.
i Rhode Island Greening.
j Perfection.
k Framboise D'Holovous.
l Lady Henniker.

Fig. 2.

a Peasgood's Nonsuch.
b Royal Late Cooking.
c Claygate Pearmain.
d Scotch Red Streak.
e Prince Alfred.
f Golden Ball.
g Glowing Coal.
h Paragon.
i Wolf River.
j Red Hawthornden.
k Kentish Fillbasket.
l Taupaki.

Fig. 3.

a Garibaldi (Adelaide).
b Early Rivers.
c Oregon Mammoth Black Twig.
d King of Tomkins County.
e Amassia.
f Baldwin.
g Golden Reinette.
h Coldstream Guard.
i Liveland Raspberry.
j Thomas Rivers.
k Akero.
l Paradise (French).

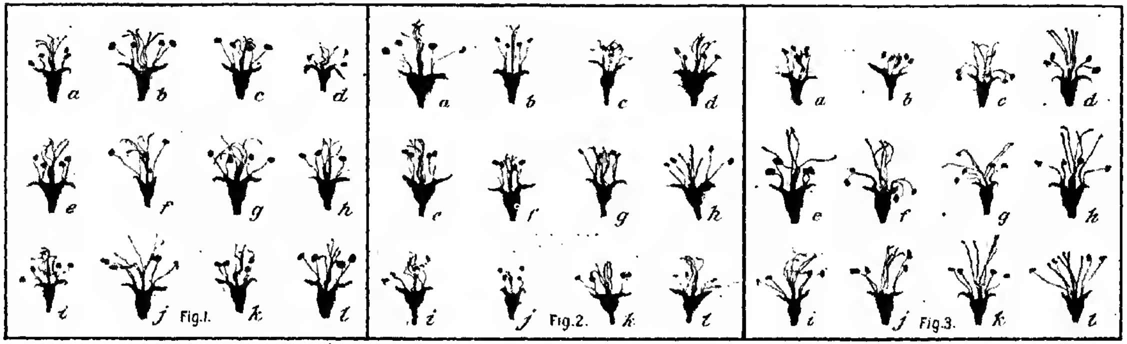


Plate 122.

Fig. 1.

a Blenheim Orange.
b Crow's Egg.
c Horn.
d Ivanhoe.
e Duchess of Oldenburg.
f Commerce.
g Climax.
h Golden Spire.
i Golden Harvey.
j Sharp's Early.
k Swaar.
l Froth's Gippslander.

Fig. 2.

a Black Ben Davis.
b Red R. B. Seedling.
c American Golden Russet.
d McIntosh Red.
e McIndoe's Russet.
f England's Glory.
g Wagner.
h John Sharp.
i D'Arcy's Spice.
j Ruby Pearmain.
k The Queen.
l Hall Door.

Fig. 3.

a Allington Pippin.
b Calville Blanch D'Hiver.
c Alfriston.
d White Nonpariel.
e Lord Nelson.
f Lincolnshire Triumph.
g Crofton Pearmain.
h Rambourg de Winnitza.
i Parlin's Beauty.
j Crisp's Russet.
k Late Gravenstein.
l Broadleaved Norman.

The intention of the writer before making and mounting the vertical sections of the flowers depicted in Plates 117 to 122 was to secure all specimens for this purpose during the period of the pistils' receptivity, so as to insure uniformity of these photographic illustrations. Experience taught, however, that this would cause much delay and expense. Consequently the sections, for identification purposes, show undesirable variations, mostly in the pistil divisions and stamens from the time of the opening of the petals until their fall.

These changes are better and more concisely illustrated in Plate 116, and they require further explanation. Specimens (*a*, *b*, *c*, *d*) are Rokewood, (*e, f, g, h*) are Morgan's Seedling, and (*i, j, k, l*) are Sturmer Pippin. These have been selected to represent the three classes previously mentioned on account of their long, medium, and short pistil unions respectively. In making the sections the petals were first dispensed with, then the sepals were almost completely removed, the pistil intact and two stamens on each side were retained, while sixteen stamens, eight on each side of the four remaining, were cut away. The object of this treatment of the blooms is to give a clear view of the pistils and stamens so that the points of difference between the varieties may be more easily observed. Specimen (*a*) shows the condition of the pistil and stamens just prior to the opening of the petals, (*b*) their condition at the opening, (*c*) during the period of pollination, and (*d*) after fertilization has taken place, when these organs commence to wither. The lettering on the Morgan's Seedling and Sturmer Pippin varieties may be read in the light of the explanation given in connexion with the Rokewood.

The illustrations showing the sections of the several varieties of flowers are about three-fourths natural size.

The many characteristics by which apple varieties can be distinguished or identified have been depicted in the foregoing illustrations and explained. It may be incidentally mentioned, however, that not alone do these variety characteristics occur in the wood, leaves, &c., of all the pomaceous and other fruits, but their blossoms when compared also show in their respective botanical construction variety peculiarities often of even more pronounced contrasts than those found in the apples.

(*To be continued.*)

NOTES ON CHEDDAR CHEESE-MAKING.

By Geo. C. Sawers, Cheese Instructor.

In the making of Cheddar Cheese, the object is to preserve the greater part of the solids of milk in such a form that they will remain in a palatable condition for a considerable time.

It is thus imperative that milk from which the cheese is to be made should be kept as free from contamination as possible, because any objectionable ferments that get into the milk will there have ample time to produce bad effects—it may be flavours, texture, or colour—before the cheese is ready for consumption. This requires the utmost care in the cleaning and scalding of all cloths and utensils with which the milk or curd is to come in contact during the process of cheesemaking, as well as observing the utmost cleanliness during the process of milking. Truly, herein lies the secret of getting timely flavoured cheese.

Treatment of Milk.

As soon as the milk is obtained it should be removed to the milk room or dairy, and strained through a sieve with a piece of butter or cheese cloth over it into the vat, and cooled as quickly as possible to about 70 degrees Fahr. by running over a cooler, when it may be left overnight in the cheese vat with the jacket full of water. Frequent stirring will not only hasten the cooling process, but will also help to get rid of cowy or other odours that may be present in the milk.

The amount of milk that can be left in the vat overnight depends on the size of the vat, the temperature, and the ventilation in the dairy. Where good facilities for cooling the milk exist, 60 or 70 gallons may be left overnight in a 200-gallon vat with safety, but it is not advisable to keep the milk in larger quantities unless cooled to below 70 deg., as it is likely to promote the growth of unfavorable ferments.

Before starters came into use, milk was left standing overnight uncooled with the object of developing acidity, and in those days discolouration in cheese was exceedingly common, and it is so yet in some dairies with no facilities for proper cooling of the milk.

In the morning the cream should be skimmed off and the temperature raised to such a point that when the morning's milk has been added the bulk will be at a suitable temperature for adding the rennet. The cream may be added along with some warm milk.

In practice this has been done, and found to be satisfactory, and it certainly assures proper distribution of the fat.

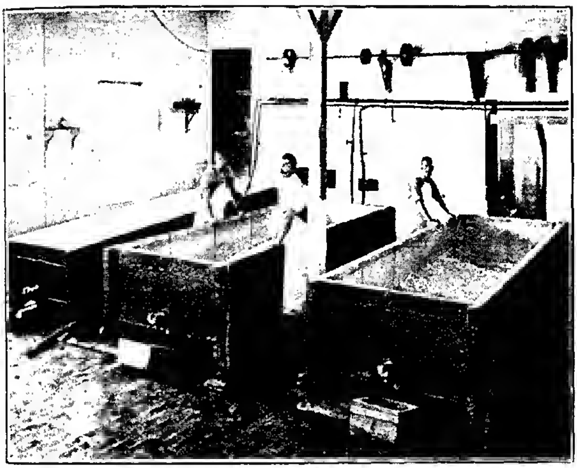
Starter.

In the morning starter should be added to promote the development of acid, the amount required varying according to the nature of the milk and the time of year. Put the starter through a straining cloth, to remove any lumps, otherwise there may be discoloured patches in the cheese. As little starter as is necessary should be used, because its action does not cease with the making of the cheese. It continues to act for a time in the curing room, and if used in excess may cause sourness and bad keeping qualities, no matter how well made the cheese may be in other respects. A small quantity added early is much better

than a larger dose just before renneting, because the cheese works steadier during the process of making, and a gradual change goes on which is so essential to long-keeping cheese.

In cases where the milk is tainted it requires more starter to hasten the development of acid, and thus keep these bad ferments in abeyance, but, if possible, have pure milk, which only requires starter to ripen it, and not to keep bad flavours in check. Under proper conditions starter at the rate of 2½ lbs. to 10 lbs. per 100 gallons should be sufficient in spring and summer, but as high as 20 lbs, may be required in fall of season.

Only good material should be used, because it is impossible to make good cheese from milk inoculated with a bad starter. A starter generally needs to be changed about every three weeks or four weeks,



Cheese-making Vats.

but the period depends on the care taken in working with it. It should not be allowed to become too sour, otherwise the vitality of the responsible organisms will be impaired, and others will gain an entrance. Nothing should be brought into contact with a starter that has not been thoroughly cleaned and scalded, and covered on top with a clean muslin cloth. Although it is advisable to use starter, it must not be forgotten that if milk could be got to ripen naturally, and soon enough to keep objectionable flavours in check, the very finest flavours would result.

The development of flavours is due to a number of agencies which work in unison, and by adding starter we upset the balance existing between these agencies, with the result that perfection is not obtained.

However, a good starter gives palatable flavours if properly used with some degree of certainty, while natural ripening is largely a matter of chance.

Colour.

For coloured cheese Annatto should be added to give a bright golden colour. The amount required varies with different milk and the season of the year. One ounce to every 50 gallons is the usual amount. Even a little may be used with advantage in the making of white cheese when the fat in the milk is of a light colour.

Rennet.

The time to add rennet is a most important point. It should be so introduced that the cheese will take from six to seven hours to make. The method adopted to ascertain the proper time at which to add rennet is described in Bulletin No. 13, page 6, which gives an approximate time, and is used generally by all makers. It stands to reason that a quick and slow starter may have developed the same amount of acid

Cheese Presses.

at the time of testing, but a few hours later the quick one may be absolutely sour, while the other may not be far advanced at all. In dairies it is of advantage to milk the cows always at a regular hour, to have the milk cooled to the same temperature under exactly similar conditions at a fixed time each night, and to control the ventilation overnight if possible, so as to have the same temperature every morning. Speaking in a general way, a small percentage of starter should be added to the milk each morning, after taking a test for acid. The morning's milk should come in at a regular hour, and its temperature raised to that required for setting. The amount of rennet to use depends on the quality of milk and the time the cheese is to be kept.

The curdling of milk by rennet may be regarded as taking place in two stages. First, the enzyme of rennet splits up the lime casein compounds into paracasein and whey albumin, and coagulation then

follows if lime salts are present. The paracasein forms the curd, and the whey albumin remains in the whey. Should the milk be deficient in lime salts there will be imperfect coagulation and a soft, weak-bodied curd. A little more rennet should be added, and it may be necessary to add in extreme cases some lime water.

In the case of milk rich in lime the curd is very firm, and less rennet should be used. The more solids the milk contains the more rennet is required to give proper coagulation in a given time. The amount of rennet to use varies with the season, quality of the milk, and strength of rennet, from 3 to 4 ounces, or in case pepsin is used, from 5 to 6 grammes to 1,000 lbs. of milk.

If rich in lime a lower temperature for setting the milk should be adopted. The curd will be very difficult to cut if the temperature be too high, while if set too low the curd will be soft, and loss of fat in the whey will result.

Cutting the Curd.

The object of this is to allow the separation of the whey to take place with as little loss of the solid constituents as possible. The curd should he cut when it splits clean over the finger, and the cutting should be done as uniformly as possible, so that the curd may be evenly cooked, and thus avoid any chances of discolouration due to soft pieces of curd. It is better to cut late rather than early, for though the curd may then be a little tougher to divide, there will be less loss of fat in the whey.

Heating the Curd.

This should be done slowly at first, increasing as the required temperature is approached. If this be not done the pieces of curd may become coated over with a hardened layer due to contact with the warmer whey, and thus prevent the proper expulsion of moisture, which will result in discolouration and probably running of whey in the curing room. The temperature to adopt varies with the season, nature of milk, and kind of cheese, Forty to forty-five minutes should allow proper heating—usually 98 degrees to 100 degrees.

Stirring should be done continuously while heating and cooking, care being taken not to smash the curd at the beginning while it is soft. The object of stirring is to get it uniformly heated, and prevent its cohering into a solid mass in the bottom of the vat. Aim at $2\frac{1}{2}$ to 3 hours from the time of setting the milk till the whey is off, if longer it is almost sure to be faulty, due to deleterious ferments coming into play. If it does not lie long enough it will be insufficiently cooked, and a soft pastey cheese will be the result. The time the curd will be in the whey is determined by the ripeness of milk when the rennet was added, and the development of acid.

Racking or stacking the curd on sides of the vat is to check the development of acid by getting rid of the greater portion of whey, and thus allowing a process of Cheddaring to take place.

The formation of acid goes on chiefly in the curd, but by getting rid of most whey the development goes on much slower. The amount of stirring to give the curd on the racks should be according to the consistency of the curd; if soft or working fast, stir for a while by hand. The object of cutting the curd in square blocks and turning over is to allow the curd to drain evenly and, as far as possible, to prevent discolouration of the surface by exposure to the air.

The timo to mill the curd is not very important. It should, however, bo thoroughly matted, generally for two hours. If the flavour be faulty, mill specially early, and allow it to mellow down longer before salting. Milling also liberates foul gases that at times accumulate in the curd, due to bad fermentations, and together with aeration stimulate the action of the ferments which bring about the mellowing process. Should the curd get cold it checks the mellowing down process, and the acid will work very slowly.

Adding salt is to preserve the curd and to improve the flavour. When salted too soon the lactic acid ferment is checked and gas-forming bacteria allowed to act, which causes the cheese to puff in the curing room. Salt causes the curd to contract and throw off moisture.

The ripening of cheese is not well understood, but as far as is known it is really a digestive process.

The lactic acid formed from the lactose present makes conditions favorable for the action of pepsin, rennet, and enzyme galactase natural to milk, and these change the insoluble albuminoids into soluble peptones and, in very old cheese, into ammonia, which gives the characteristic nip to the taste of cheese. If cheese is too sweet or too acid these ferments do not seem to act properly, and the formation of peptones is slow, and the cheese retains a harsh objectionable texture.

The fat in cheese undergoes no change, except, perhaps, in very old cheese, where some of the fatty acids may become liberated.

THE MILLING AND BAKING QUALITIES OF AUSTRALIAN WHEAT.

(By P. Rankin Scott, Chemist for Agriculture, and F. G. B. Winslow, Milling Expert.)

Introductory Remarks.

Wheat-growing is one of the staple industries of our Commonwealth, the production in New South Wales, South Australia, Western Australia, and Victoria being approximately four and one-half times greater than the amount required for local consumption, while the surplus is shipped overseas. To regulate the quality of the wheat exported, a standard of quality is struck each year by the corn section of the Chambers of Commerce of these States. This is known as the fair average quality —F.A.Q. standard—and it is claimed for each year's standard that it is fairly representative of the quality of the wheat grown. The standards fixed are from the average available supply of 135,000,000 bushels, the yield of the separate States being: Victoria, 50,000,000 bushels; South Australia, 40,000,000; New South Wales, 31,500,000; and Western Australia, 13,500,000 bushels. (These totals do not include the amount retained for seed wheat and chick feed.) The estimated quantity required for home consumption is 30,000,000 bushels, leaving in normal years a surplus of 105,000,000 bushels for export as wheat or for milling into flour for export. Following the usual custom, a series of tests have been made, in order that any variations in quality, resulting from

climatic conditions during the growing period, might be noted. Tests were made for:—

1st. Determination of the amount of impurities, and the proportion of the various ingredients.

2nd. Grading the wheat into different sizes, and the proportion of the various ingredients of each size.

3rd. The bushel weights of original and cleaned weight.

4th. The milling test.

5th. The gluten content, the strength, and the colour of the flour.

6th. The baking test.

The following table shows the amount of foreign matter found in wheats from the different States:—

Table I.—Showing Amount of Foreign Matter and Relative Percentage of Each Ingredient.

(1,000 grams taken).

—	Barley.	Chaff.	Drake.	Oats.	Rubbish.	Smut.	Stem.	White-heads.	Wild Oats.	Weed Seeds.	Per cent.
New South Wales ..	0·48	1·52	0·05	0·56	0·52	0·12	0·07	0·19	0·48	0·14	0·413
South Australia	2·41	1·47	2·34	0·36	0·84	0·79	0·38	0·38	0·14	0·14	0·925
Western Australia ..	2·67	1·73	1·46	0·31	0·34	0·09	0·06	1·29	0·06	0·04	0·805
Victoria	1·79	2·98	2·23	1·84	0·48	0·22	0·28	0·61	0·33	0·27	1·103

Unthreshed Heads.

New South Wales..	..	..	..	..	2.04 %
South Australia	..	..	..	..	0.62 ,,
Western Australia	..	..	..	..	0.40 ,,
Victoria	..	..	..	..	1.59 ,,

The impurities present in the largest quantity in all the samples are barley, chaff, and drake, the Victorian sample containing, in addition, a fair amount of oats. Every effort should be made to remove these impurities at this end, for not only would their absence increase the milling quality of wheat, but, further, freight charges would be lessened. Calculated on bulk samples examined, it is estimated that in a normal year, 24,000 tons of these foreign bodies are sent overseas mingled with our wheat, and while they are useless for milling purposes, they are suitable food for cattle and horses, and could be used to advantage here.

The statement hereunder shows the percentage of foreign matter found in the wheats tested for the seasons 1912-13 to 1916-17:—

Table II.—Showing the Percentage of Foreign Matter Found in Tests for 1916-17, as well as those of Previous Seasons.

Season.	New South Wales.	South Australia.	Western Australia.	Victoria.
1912-13	0·37	0·77	..	0·71
1913-14	0·71	0·92	0·61	0·79
1915-16	0·60	1·72	0·98	1·41
1916-17	0·41	0·92	0·80	1·10

The Grading Test.

The wheat, after all the foreign ingredients have been removed, is graded into seven sizes. This is done by means of a set of hand sieves ranging in size of mesh from 3.25 mm. down to 2 mm. mesh. The results obtained are set forth in the subjoined tables:—

Table III.—Showing Amount of Grain Retained on Sieves of Varying Mesh.

(1,000 grams taken).

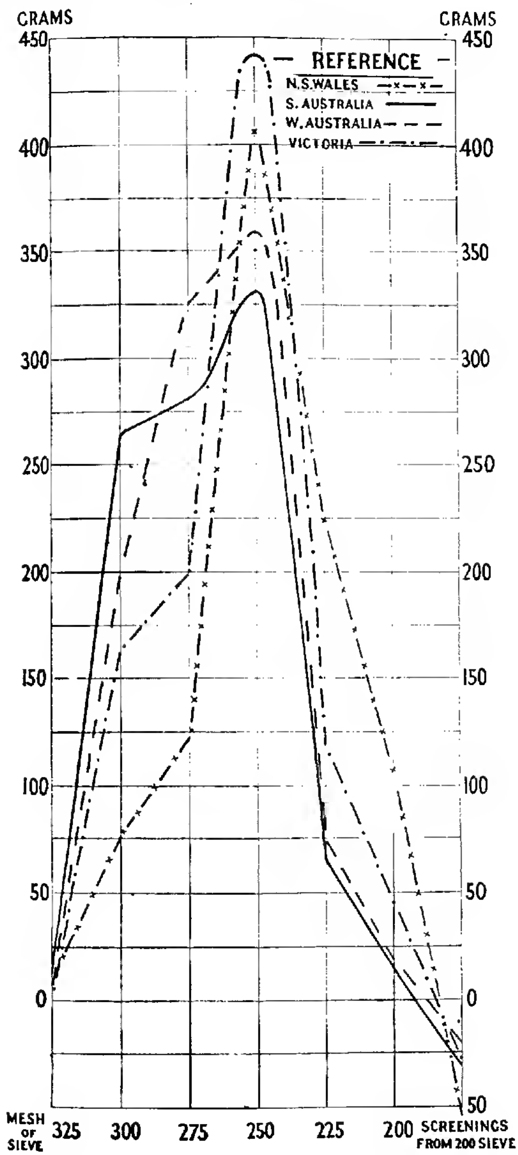
State.	Size of Mesh.						
	3·25 Mesh.	3·00 Mesh.	2·75 Mesh.	2·50 Mesh.	2·25 Mesh.	2·00 Mesh.	Screenings under 2·00
	grams.	grams.	grams.	grams.	grams.	grams.	grams.
New South Wales ..	9·5	75·5	122·5	407·0	224·0	107·0	54·0
South Australia ..	13·5	263·5	280·5	333·0	65·5	14·0	30·0
Western Australia	5·0	198·5	325·5	358·5	74·0	17·5	21·0
Victoria	4·0	162·0	199·5	442·5	118·5	45·5	28·0

Table IV.—Showing Percentage of First Grade Grain (Retained by 2.75 mm. Sieve) Compared with Previous Tests.

—	1912.	1913.	1915.	1916
New South Wales ..	62·2	60·1	54·9	29·7
South Australia ..	59·5	43·0	53·5	55·1
Western Australia ..	..	56·6	32·0	52·9
Victoria	70·8	54·8	57·5	36·5

The size of the grains of wheat is of some direct importance to the miller, who, as a rule, favours a large, well-developed grain, and the more uniform the sample, the better suited it is for milling. The larger the grain the more flour may be expected from the majority of varieties. In a composite sample this may not always be so, as some varieties have a thicker branny layer than others. All wheats contain a varying percentage of cracked and shrivelled grain, which must be removed before the wheat is fit for milling. Grading the wheat before shipment would remove these grains, and the tonnage would thus be considerably lessened. The extent to which this can be done will vary according to the percentage of screenings in the sample of wheat. For this year the bulk sample shows a percentage of 4.35 of screenings, equivalent to 12,408 tons.

It will be seen on referring to the graph on page 477 that the curves representing the South and Western Australian wheats agree very closely, while those representing Victoria and New South Wales show a


GRAMS
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GRAMS
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200
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100
50
0
50
REFERENCE
N.S.WALES
S. AUSTRALIA
W. AUSTRALIA
VICTORIA
MESH OF SIEVE
325
300
275
250
225
200
SCREENINGS FROM 200 SIEVE

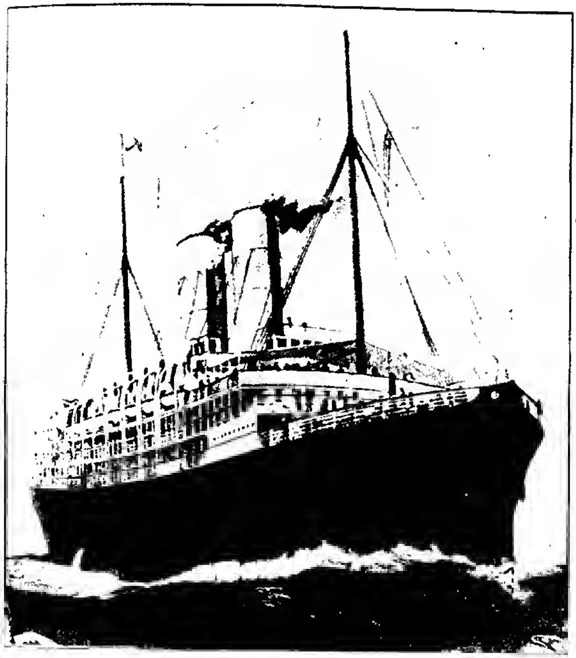
somewhat similar agreement up to mesh 2.50 mm., after which the proportion of small grains shows a decided increase in the New South Wales sample. The cause of the smallness of the grain in the New South Wales crop was the unfavorable conditions during the growing season, which resulted in the yield being poor, the quality also suffering.

TABLE V.—MILLING TESTS, F.A.Q. SAMPLES, 1916-17.

State.	Cleaned Wheat, Bushel Weight.	Dirty Wheat, Bushel Weight.	Moisture used in Conditioning.	Break Flour.	Flour.	Bran.	Pollard.	Colour.	Strength.	Wet Gluten.	Dry Gluten.	Moisture Content, Wheat.	Moisture Content, Flour.	Remarks.
	lbs.	lbs.	c.c.m.	%	%	%	%	20 Points Max.	Quart Water, 200 lbs. Flour.	%	%	%	%	
Victoria..	64·7	60·25	50	7·5	69·2	17·2	12·6	15·5	47·0	19·25	7·11	11·70	13·06	Grain, light appearance, soft; absorbed water in conditioning very rapidly; very easy to over-condition; bran, broad, fairly thin; flour, soft, fair bloom
South Australia	64·9	62·	60	6·4	73·7	16·3	10·0	15·5	47·6	19·66	6·7	11·34	13·07	Grain, rather dull appearance; bran, broad, very easy reduction; flour, soft, good bloom
New South Wales	60·9	58·75	45	5·4	68·6	21·0	10·4	11·5	41·3	18·82	7·0	11·53	13·06	Grain, dull appearance, difficult to condition; bran, broad, thick, reductions difficult; flour, soft, fair appearance
Western Australia	67·1	62·75	60	3·6	74·9	17·4	7·7	17·	49·9	22·9	8·01	10·38	12·3	Grain, semi-translucent, very bright appearance; bran, fairly broad; flour, good bloom, excellent milling wheat

The water required to condition the wheats was higher in quantity than usual. The time required to condition was, if anything, shorter. The wheats from South and Western Australia returned a high percentage of flour, those from Victoria and New South Wales giving a poor percentage. The colour of the flour in all was considerably below the average. That from Western Australian flour showed the best of a moderate lot, giving a flour of good strength and gluten content. None of these wheats may be considered of high quality for gluten or for their water absorption capacity. The available tonnage of wheat was 2,814,008, and this quantity, if gristed, would on a 70 per cent. flour basis return 1,868,713 tons. Taking the carrying capacity of the ships engaged in transporting the wheat at approximately 4,500 tons, the number of shiploads required to transport the wheat would total, in round figures, 625, while if the wheat were milled here and the flour exported, the shipping would be reduced by one-third, *i.e.*, it could be transported in 415 loads.

Besides the immense saving in shipping and the increase in local industry there would be a further gain if all our wheat were milled in the Commonwealth, and that is the retention of wheat offals, screenings, &c., which could be profitably used here. Perhaps the illustrations



Wheat Offals—178 Shiploads. (Bran, Pollard, &c.)

Screenings—27 Shiploads. (Crocked and Shrivelled Grain.)

Impurities—5 Shiploads. (Oats, Barley, Chaff, &c.)

on this page will help to visualize for readers the great quantity of these by-products that are annually lost owing to our inability to mill the whole of our wheat harvest.

TABLE VI.—BAKING TESTS ON F.A.Q. WHEAT, 1916-17.

State.	Colour. 20 Points Max.	Texture. 20 Points Max.	Weight of 1lb. Loaf. in Grams.	Volume. c.c.m.	Water absorbed in Making Dough. c.c.m.	Points for General Appearance 20 Points Max.	Remarks.
Victoria ..	15	15	479	1,485	200	18	Very fair rise in oven, worked well in dough, crust inclined to be fiery
South Australia..	18	18	481	1,490	202	19	Very fair rise in oven, worked well in dough, crust inclined to be fiery
New South Wales	16	16	465	1 525	176	19	Good rise in oven, worked well in dough good colour crust
Western Australia	16	16	504	1,510	216	20	Good rise in oven, worked well in dough, excellent colour crust

The volume of the loaves was scarcely up to former tests, while the colour and texture were inferior with the exception of the loaf baked from the South Australian flour, the New South Wales flour returning a comparatively light loaf. The baking quality of the flour, generally speaking, was not up to previous tests.

SUMMARY.

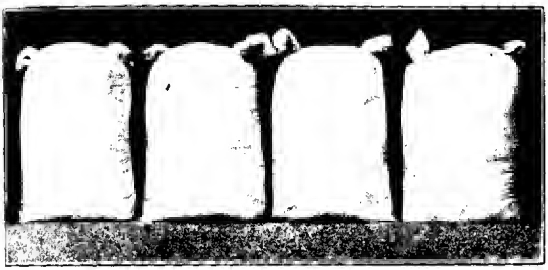
Just as "truth embodied in a tale" is at times made more apparent to some minds, perhaps the results of our experiments regarding the milling and baking qualities of the *f.a.q.* wheats of each of the grain-growing States of Australia may be best summarized by means of the series of pictures on the opposite page.

It might be well to state here that the quantity of clean wheat required to mill 2,000 lbs. of flour was fixed by using the bushel weight struck by each State.

While the number of loaves specified in the illustrations opposite is mathematically correct, some concession must be given for unavoidable losses, and an allowance of, say, 40 loaves per 2,000 lbs. of flour, should be made in order to arrive at an estimate of the actual returns that would be obtained in the bakehouse.

Victoria, 47·5 bushels | **South Australia, 45·3 bushels** | **New South Wales, 51 bushels** | **West Australia, 42·7 bushels**

will yield



Each Bag represents 2,000 lbs. of Flour.

which will give

Number of 4-lb. Loaves Baked—

Victoria, 703. | **South Australia, 707.** | **New South Wales, 684.** | **West Australia, 741.**

THE POMOLOGICAL COMMITTEE OF AUSTRALIA.

1917 MEETING.

(*E. E. Pescott, F.L.S., Pomologist, Department of Agriculture, Victoria, Secretary.*)

The Pomological Committee of Australia held its fourth conference at Sydney, and at the Bathurst Experiment Farm, New South Wales, in April, 1917. The following delegates were present:—Messrs. W. J. Allen, Department of Agriculture, New South Wales; C. C. Tucker and F. Chilton, Fruitgrowers' Association of New South Wales, and F. J. Adamson, Nurserymen's Association of New South Wales; Messrs. J. M. Ward, Department of Agriculture, Tasmania, and L. M. Shoobridge, Fruitgrowers' Association of Tasmania; Messrs. Geo. Quinn, Department of Agriculture, South Australia, and Geo. Laffer, M.H.R., Fruitgrowers' Association of South Australia; Messrs. Jas. Lang, J.P., Fruitgrowers' Association of Victoria, and E. E. Pescott, F.L.S., Department of Agriculture, Victoria, secretary. Mr. C. C. Tucker being taken suddenly ill at the first session, his place was taken by Mr. E. K. Wolstenholme. It is to be recorded with regret that the death of Mr. Tucker occurred on the day that the conference closed its sessions. The Committee desire to record here, with great regret, the death of Dr. Harry Benjafield, of Tasmania, which occurred in June. Dr. Benjafield was one of the early promoters of Pomology in Australia, and his loss will be keenly felt by the Committee. Mr. James Lang, the 1916 chairman, opened the proceedings, and Mr. L. M. Shoobridge was afterwards chosen as chairman. The report of 1916 was adopted, and it was decided to include in future reports all previous decisions, so that each report would be complete.

Representation of Various States.—The Secretary read correspondence from Queensland and Western Australia, neither of which States could see its way clear to send a representative to the Conference—the principal reason why Western Australia was not represented being the distance which the representative would have to travel.

The secretary was asked to write to the Department of Agriculture, Queensland, and ascertain if it were willing to agree to the decisions arrived at by the Conference.

Report of Proceedings.—In order that no particular State would receive the report of the proceedings of the Conference before the other States, it was decided to have a copy of same forwarded to each Department to be printed simultaneously in the August number of their official publication. It was also decided that the report should be made retrospective since the inauguration of the Committee.

Fruit Models.—The Secretary informed the Committee that he had placed an order with Mr. White for four sets of models of 23 varieties. He had recently received advice from Mr. White that, owing to illness, he had been unable to complete the full number, and now required twelve specimens to get the exact colouring of them. A number of varieties was selected for this purpose.

The Secretary also stated that Mr. White informed him he would not undertake to make further models unless for an order amounting to

£200. The Committee decided that, when the present order was completed, if found to be satisfactory, the question of having additional models would be considered.

Standard Fruit Case.—Mr. Laffer said it was most desirable that all the States should fall into line with regard to a standard fruit case, as South Australia had recently shut out a quantity of Tasmanian fruit, owing to the cases being of a different size to those used in South Australia.

Mr. Ward urged that a variation of 2½ inches (more or less) should be allowed in the cubic content of the different fruit cases. He said it was impossible to accurately estimate the difference which would take place through shrinkage or expansion between the cutting of the timber and the making of the case, owing to the different kinds of timber used, and some of it being more seasoned than others.

The following motion was moved by Mr. Laffer, seconded by Mr. Lang, and carried.

> "That this Conference urges upon the States which have not already adopted the standard fruit cases agreed upon at the Minister's Conference in Brisbane, in 1914, to do so at the earliest possible moment, in order that uniformity may be brought about in connexion with the fruit trade of the different States of the Commonwealth."

It was decided to bring this motion under the notice of the Under-Secretary, Department of Agriculture. New South Wales, and ask him to transmit same to the Departments in the other States.

Method of Invitations to Members and Representatives.—Mr. Laffer moved that the Departmental representative in each State should act as Secretary to the Committee in that State, and should be the medium through which invitations to members should be issued; also, that he be empowered to invite any prominent fruitgrowers who would like to attend the Conference. Seconded by Mr. Ward. Carried.

Certificates of Merit.—Mr. Allen moved that the Committee prepare a list of well-known seedlings (apples and pears), raised in the different States, and that the representative of each State should furnish full particulars, descriptions and photographs of the varieties raised in his State, at the next Conference. Seconded by Mr. Ward. Carried.

Local Sub-Committees.—Mr. Ward presented a report from the Tasmanian Sub-committee of the Pomological Committee, showing the work which had been done by that body since the last Conference.

It was moved by Mr. Lang, and seconded by Mr. Allen, that the report be received. The report referred to seedling soft fruits.

No reports were received from the other States.

Co-operation of Nurserymen.—Mr. Laffer suggested that the Government representatives of the Committee in each State, should give the nurserymen an opportunity of meeting them, and discussing what has been done by the Pomological Committeee. He thought that a personal interview of this kind would be of great assistance in getting the nurserymen to adopt the decisions of the Conference.

Blight-proof Apples.—Mr. Allen presented a carefully prepared list showing which varieties were free from, or more or less affected with "Woolly Aphis" in New South Wales. He stated that in one district an apple would be free from this pest, whilst in another part of the State it would be badly affected.

The President stated that the same trouble was found in Tasmania with regard to the variation in freedom from "Woolly Aphis," under different climatic conditions.

Mr. Ward said that in the northern part of Tasmania apples were badly affected in some districts, whilst in the southern portion they were particularly free from it.

Mr. Lang moved that the list submitted by Mr. Allen be received; that the other States produce similar lists at the next Conference, and from the combined lists a list covering commercial varieties for the whole of Australia be prepared. Seconded by Mr. Chilton. Carried.

Mr. Quinn suggested that Queensland and Western Australia should be written to and asked to prepare lists of varieties of apples more or less affected with "Woolly Aphis," for the above purpose.

Descriptions of Fruits.—In order to have a uniform method throughout the various States of taking descriptions of fruits, a form for this purpose was drawn up and adopted.

It was also agreed that specimens should be as nearly as possible typical of varieties and of average size. The form appears at the end of the report.

Deferred Nomenclature from 1916.

Strawberry Pippin.—Mr. Allen submitted specimens of Winter Strawberry as grown in New South Wales. There were also specimens of Strawberry Pippin from South Australia and Tasmania.

Mr. Lang moved that the Winter Strawberry, as staged by New South Wales, be accepted as correct; that the apple grown in South Australia as Strawberry Pippin is identical with the New South Wales Winter Strawberry. Seconded by Mr. Ward. Carried.

Note.—Mr. Ward to inquire and report to the Committee next year *re* Strawberry Pippin in Tasmania.

Carrington and Lady Carrington.—Mr. Allen apologised for not having specimens of these apples at the meeting.

Mr. Pescott stated that specimens of apples submitted to him about three years ago as Carrington, from trees supplied by Mr. Nobelius, were determined by him to be Thorle Pippin. For this reason he brought the matter before the Pomological Committee, and also for the reason that an apple is grown in Victoria under the name of Carrington which is really Aiken's Seedling. He referred this matter to Mr. Nobelius, who stated that the apple distributed by him as Carrington was obtained from the Burnley Gardens.

Mr. Tucker said that the Carrington was purely a coastal apple in New South Wales. He stated that he had several acres of apples, and none of them did better with him than did the Carrington (red), which is absolutely blight-proof.

Mr. Edgell said it was not suitable for the Bathurst district.

Mr. Quinn asked if there were two Carringtons, or only one.

Mr. Adamson replied that in New South Wales there were two—the red and striped—the only variation being the difference in colour. Carrington is absolutely blight-proof, and in his opinion it made a better stock than did the Northern Spy, as it makes stronger and far less fibrous roots. When worked, the two types—red and streaked—show a tendency to revert to either type.

Mr. Tucker moved that the Carrington apple be recommended as a purely warm coastal apple, and not suitable for cold districts. Seconded by Mr. Adamson. Carried.

Dutch Mignonne.—The Secretary said he had made inquiries with regard to the variety, and had ascertained that it was received in Victoria from South Australia. It was suggested that the labels were mixed at the time the trees were received, and the different varieties probably confused.

The specimens submitted from Tasmania were not accepted as true to name, and Mr. Ward was instructed to submit further specimens at the next Conference.

Exhibits.—About 420 dishes of fruit were exhibited by the members, 280 being apples. The following seedlings were discussed, and were recommended for further consideration at the next meeting:—

Streamville, raised by Mr. Murphy, Aitken's Creek, Victoria.
Brown's Pippin, raised by Mr. Brown, New South Wales.

Thompson's Red Seedling.—Mr. Chilton submitted specimens of this apple which had been kept in cool store since the middle of March.

Mr. Lang moved that, as the apples showed signs of black spot, they should be deferred for consideration until next year, and that some other name should be suggested for the variety. Seconded by Mr. Ward. Carried.

Granny Hunter.—Mr. Allen submitted specimens of this apple which was grown by Mr. A. Hunter. The Penang, Gosford. They had been kept in cool store for a considerable time, and were not in the best condition. It was decided that the New South Wales Sub-committee should obtain specimens when they were in season and condition, and report on them at the 1918 Conference. It was also suggested that the name should be changed to Penang.

Hornsby.—Specimens of an apple grown by Mr. Higgins, Hornsby, were submitted by Mr. Allen. Mr. Laffer suggested calling the variety Hornsby, and that further specimens be obtained for display at the 1918 meeting. This was agreed to.

Ebenezer Pippin.—Mr. Allen submitted specimens of this variety. It was decided that the New South Wales Sub-committee should obtain specimens next season, when ripe, and report on same at the 1918 Conference.

Jupp's Surprise.—Samples submitted by Mr. Allen. As this apple was not as good as a great number of other commercial varieties, it was moved by Mr. Lang and seconded by Mr. Pescott, that it be rejected.

Shepherd's Seedling.—Specimens were submitted from the Goulburn District exhibit at the Royal Show. The Committee was very favorably impressed with this apple, and it was decided that further specimens should be obtained for the next Conference. As there are a good many apples with the word "Shepherd" appearing in the name, it was suggested that the grower should select another name for the variety.

Jackson's Seedling.—From South Coast District exhibit at Royal Show. Mr. Chilton reported that it was a good selling apple for local trade, and suggested that the name should be changed to Keira. It was decided that Mr. Allen should obtain further specimens for display and report at the next Conference.

Croton.—Submitted by Mr. Ward. As the name was very similar to Crofton, Mr. Ward suggested that it should be changed to Ranelagh, the name of the district in which the apple was raised.

Moved by Mr. Lang, and seconded by Mr. Ward, that the name be changed to Renelagh. Carried.

Tasma.—Mr. Ward stated that this variety was also known as Democrat and Tasman, which caused considerable confusion amongst growers. It was decided to call the variety Tasma, and to ask the nurserymen to sell the trees out under this name only.

Australian Beauty.—Submitted by Mr. Ward.

Moved by Mr. Pescott that, owing to the absence of information regarding this variety, it be deferred until next season, and, in the meantime, Mr. Ward should make inquiries in order to ascertain if it is a sport from Ben Davis. Seconded by Mr. Laffer. Carried.

Mr. Ward submitted an unnamed seedling grown by Mr. Judd, Huon, Tasmania. He had no information regarding the apple.

Mr. Pescott moved that, owing to the absence of information regarding this variety, it be deferred until next Conference. Seconded by Mr. Lang. Carried.

Lord Kitchener.—Grown by Mr. Wallace Kellaway, Huon; submitted by Mr. Ward. The specimens produced were of poor quality, and it was moved by Mr. Lang that better specimens be produced at next Conference, also that the grower be asked to change the name. Seconded by Mr. Pescott. Carried.

Franklin Belle.—Grown by Mr. Freeman, Franklin.

Mr. Pescott moved that, as there were many better commercial varieties under cultivation, it could not be recommended for general planting. Seconded by Mr. Wolstenholme. Carried.

Huon Belle.—From the same source as Franklin Belle. This was a yellow, conical apple of bright colour, indifferent flavour, and with a short stem. It was decided that it could not be recommended for general planting.

Mr. Ward submitted a blight-proof seedling grown by Messrs. J. Clark & Son, Launceston. It could not he considered a standard commercial apple, and it was decided not to recommend it for general planting.

Mr. Ward submitted an apple obtained from Mr. S. T. B. Couch, Representative Two Bays Nursery, Huon. He stated that 51 apples had grown on a lateral 18 inches long, and they were very free from black spot. The origin of the tree was unknown .

Moved by Mr. Ward that it be deferred until next meeting; that the name be ascertained and inquiries made with regard to the variety in the meantime. Seconded by Mr. Lang. Carried.

Mr. Ward submitted a seedling apple from Mr. Stewart's orchard, St. Leonards, near Launceston. It was of poor quality, and could not be recommended for general planting.

Sturmer Seedling.—Grown by Mr. Waldron, Wyena, Tasmania.

Moved by Mr. Pescott, and seconded by Mr. Lang, that Mr. Ward make full inquiries with regard to this variety, and report on same at the next Conference.

Mr. Ward submitted a seedling apple grown by Mr. Widdowson, Georgetown, Tasmania. This was identified by Mr. Shoobridge as "Port Dalrymple," which has been growing in Tasmania for many years.

Two Bays Seedling.—Grown by W. G. Elliston, Latrobe, Tasmania. The President stated that it was very similar to Coleman's Late Aromatic, and was possibly wrongly named. Mr. Ward was asked to make inquiries and report on this apple at the next Conference.

Lang's Seedling.—Submitted by Mr. Lang. To be exhibited and reported on at the 1918 Conference.

Seedling Pears.

New South Wales.

Mr. Allen submitted specimens of seedling pears from Mr. Gazzard, Clergate. As there are many other better varieties coming in at the same season, it was decided that this one could not be recommended for general planting.

Mr. Allen said he would obtain specimens of a seedling from Packham's Triumph for next Conference.

Tasmania.

Judd's Beurre.—Raised by the late Mr. Judd, Franklin, Tasmania. It was decided that this pear was not of the best quality, and could not be recommended for general planting.

Consideration of General Exhibits.

New South Wales Apples.

Duke of Wellington.—Grown at Mt. Keira. This apple is of nice appearance, is somewhat like Yates in shape, but of better colour. It is a heavy cropper, and said to be blight-resistant.

It was decided that New South Wales Sub-committee should make investigations with regard to this variety and report on same at the next Conference.

Red Fire Crown.—Obtained from Goulburn District exhibit at Royal Show. Raised by Mr. Best, Tannangaroo. This is a bright-streaked apple with the colour extending far into the flesh; is very similar to Coleman's Late Aromatic (Tasmania).

New South Wales Sub-committee to investigate and report at 1918 Conference.

Nigger Head.—Obtained from Goulburn District exhibit at Royal Show. This apple is very dark, much darker than Hoover, and much like Arkansas Black.

New South Wales Sub-committee to investigate and report in 1918.

Goulburn Beauty.—From Goulburn District exhibit at Royal Show. An apple of good colour, appearance, and flavour.

To be kept in view by the New South Wales Sub-committee and reported on at the 1918 Conference.

Beauty of Australia.—Grown at Mt. Keira. Determined to be identical with the South Australian apple of the same name.

Mr. Chilton submitted an apple grown by Mr. Franks, Pennant Hills, and supposed to have been originally obtained from Tasmania.

Moved by Mr. Lang, and seconded by Mr. Chilton, that it was identical with Dunn's Favorite.

Mr. Allen submitted specimens of an apple grown by Mr. Wollard, Moorilda. The specimens resembled Cooper's Market, but could not

be identified by the Committee. Mr. Allen was asked to obtain further specimens for next Conference.

Two varieties of apples, grown by Mr. Larsen, Stonehenge, were submitted by Mr. Allen. One was a large greenish-yellow apple, very subject to bitter pit, and badly shaped; it was not considered worth growing for commercial purposes. The other, a large yellow apple, was identified as Gloria Mundi.

Specimens of an apple planted at Bathurst Experiment Farm as Blondin were submitted. It could not be identified, and it was decided to forward specimens to the next Conference.

Specimens of an apple (supposed to be a seedling) were submitted from F. R. Auberson, March, near Orange. It was not identified, and Mr. Allen was asked to submit further specimens at the next Conference.

Lady Hopetoun.—Grown by Mr. W. Grunsell, Parkesbourne. It was decided to have further specimens at next Conference, and also to have specimens of the same variety from Victoria.

Tetofsky.—Grown by A. Hunter, The Penang, Gosford. This was determined by the Committee to be the Russian apple Tetofsky. It is of poor quality, and is not recommended for planting.

Loddington (described as imported).—Grown by A. Hunter, The Penang, Gosford. This variety was determined to be true to name, but is not recommended by the Committee for general planting.

Garibaldi.—Grown by F. R. Auberson, March, near Orange. Decided to be true to name.

Fall Beauty.—Submitted by Mr. Allen. Name possibly correct. Could not be recommended for general planting. Grown by A. Hunter, Gosford.

Mr. Allen submitted an apple forwarded by Messrs. Searl & Co., Sydney. As only one specimen was submitted, it could not be identified.

Mr. Chilton submitted an apple obtained from J. A. Wheatcroft, Dunolly, Tasmania, as Alfriston. The Secretary stated that the same apple had been submitted to the Conference in 1914, and was identified as Flower of Kent. It was decided that Mr. Ward should obtain all possible information with regard to this apple, and also submit specimens at the next Conference. Mr. Lang has also to submit specimens of Flower of Kent, as grown at Harcourt, Victoria.

Mr. Chilton submitted another apple obtained from Tasmania. He had no information with regard to the locality from which it came, or of the variety. It was apparently a seedling, and could not be identified by the Committee.

Blenheim Orange.—Mr. Ward submitted specimens of an apple grown under this name by Messrs. J. Clark & Son, Launceston, Tasmania. It was deferred until 1918 Conference, when Mr. Ward would submit further specimens.

Specimens of an unnamed variety resembling Striped Beefing were submitted by Mr. Ward. The specimens were inferior to this variety, and could not be recommended. Grown by Mr. C. Ling, Penguin, Tasmania.

Further specimens from the same grower were submitted by Mr. Ward. These resembled Rymer. It was decided to bring this variety up again for consideration at the next Conference.

Specimens of a late apple were submitted by Mr. Ward. These were grown by Mr. H. Stapleton, Youngtown, Tasmania, and are very similar to Majetin. It was decided to have further specimens for consideration at the 1918 Conference. This is considered a good variety and well worth following up.

Mr. Ward submitted another variety from the same grower. These were very much like Dutch Mignonne. Further specimens are to be submitted and discussed at the 1918 Conference.

Specimens of a variety grown as Kirk's Perfection, by Mr. C. White, Beaconsfield, Tasmania, were submitted by Mr. Ward. They were identified by the Committee as Moss' Incomparable.

Mr. Ward submitted specimens from D. Weston, Launceston. These were somewhat decayed, and could not be identified. They were probably Twenty Ounce. Mr. Ward is obtaining further specimens for next Conference.

Pears.

Mr. Chilton submitted samples of pears grown at Wenona, Capertee, as Beurre de Capiaumont. They could not be identified as this variety. They were very similar to Colmar. Mr. Chilton is to obtain further specimens for next Conference.

Mr. Chilton also submitted specimens of pears grown by Mr. Perrett, Turramurra. These were identified as Garber's Hybrid.

Mr. Allen submitted specimens grown at Yanco and Bathurst Experiment Farm as Josephine de Malines, the tree of which originally came from Victoria. They were not identified by the Committee as this variety. They were well thought of, and Mr. Allen was asked to submit further specimens at the 1918 Conference.

A pear grown by Mr. Peacock, at Kelso, as Callebasse Bosc was determined to be Callebasse Grosse.

Specimens of pears grown by Mr. R. L. Richmond, Glenlusk, Tasmania, as Easter Beurre were submitted by Mr. Chilton. They were similar to Flemish Beauty, and further specimens are to be exhibited by Mr. Ward at the next Conference.

Specimens of another variety from the same grower were submitted. These were of good quality, and Mr. Ward was asked to obtain all information with regard to them, also further specimens for the 1918 Conference.

Mr. Chilton submitted a pear grown by Mr. T. P. Lock, Premaydena, Tasmania. This could not be identified, and Mr. Ward was asked to obtain further specimens for next Conference.

Another pear was submitted from the same grower, and it was also deferred until next year.

Mr. Ward submitted pears from C. R. Burnside, Deviot, Tasmania. These were identified as Souvenir du Congres. Further specimens are to be submitted at the next Conference, and Mr. Allen is also going to exhibit some of the same variety.

A pear grown by Mr. C. Perrin, Launceston, was submitted by Mr. Ward. As only one specimen was exhibited, it could not be identified, and Mr. Ward was asked to obtain further specimens for next meeting.

Mr. Quinn submitted specimens from a 50-years' old tree in the Government Orchard, Kybyolite—a cool district. These were determined to be Beurre Rance.

Further specimens from the same orchard were out of condition and could not be identified.

Small Russett pears from the same source could not be identified, and were considered too small to be worth consideration.

Other large specimens from the same orchard were deferred for consideration until the 1918 Conference.

Mr. Quinn promised to obtain better specimens of the above varieties for next Conference.

Mr. Laffer submitted specimens from the Mylor Orchard, South Australia.

These were considered to be very similar to Nec Plus Meuris, of Van Mons. Mr. Laffer was asked to submit further specimens at the next Conference, when specimens of the Nec Plus Meuris would also be exhibited.

Mr. Laffer submitted specimens grown by him at Belair, South Australia. It was suggested that these were Lawrence. He was asked to submit further specimens next year, when the variety Lawrence would also be displayed.

Another pear submitted by Mr. Laffer from the same orchard was decided to be Conference.

Change of Name.

At previous Conferences, the Committee decided, for various reasons, to make changes in the nomenclature of certain fruits. The following is a list of the changes made:—

APPLES.

Old Name.	*New Name.*
Five Crown Pippin	London Pippin
Dumelow's Seedling	Dumelow
Democrat	Tasma
Dunn's Seedling	Dunn's Favourite
Munroe's Favourite	Dunn's Favourite
Stewart's Seedling	Stewarts
Schroeder Apfel	Schroeder
Emperor Alexander	Alexander
Trivett's Seedling	Trivett
Mellon's Seedling	Dunolly
Yapeen Seedling	Yapeen
Yeate's Nonpareil	Gowar
Stayman's Winesap	Stayman

PEARS.

Old Name.	*New Name.*
William's Bon Chretien	Williams
Bartlett	Williams
Duchess	Williams
Napoleon	Vicar of Winkfield
Vicar of Winkfield	Vicar of Winkfield
Giblin's Seedling	Giblin's Nelis
Kieffer's Hybrid	Kieffer
Harrington's Victoria	Harrington
Laffer's Nelis	Laffer
Laffer's Bergamot	Laffer

Mr. Ward referred to the Tasman apple being sold in Tasmania as Democrat. He moved that the Secretary write to the nurserymen in

Tasmania and Victoria asking them to adopt the name of Tasma, as decided upon by the Committee. Seconded by Mr. Lang and carried.

At the 1917 Conference the names of two fruits only were changed. These were—

(*a*) The name of the Tasmanian apple, Croton, was changed to Ranelagh. The name Croton is very like that of the apple Crofton, which is largely grown in Tasmania, and the name Ranelagh was selected as being the district in which this seedling was raised.

(*b*) *Pomme de Neige.*—Mr. Allen moved that as this apple was originally called Fameuse, after the village in Quebec, where it was raised, the question of re-naming the variety should be considered. Seconded by Mr. Ward. Carried.

After considerable discussion, the following motion was moved by Mr. Allen, seconded by Mr. Ward, and carried:—

"That the name of the apple known as Pomme de Neige be changed to Fameuse; that in his report the Secretary give a *résumé* of the history of this apple, stating the reason why the name has been changed."

Apple Fameuse.—The apple which is catalogued, and so well known throughout Australia as Pomme de Neige is correctly called Fameuse. It is known and recognised only by this name in America, its country of origin; and following on the decision of the Australian Committee to adopt nomenclature of other lands, the correct name of Fameuse has now been adopted.

The history of the Fameuse is somewhat obscure, but it is generally supposed to have been raised at Fameuse, in Canada, from seed brought to Canada from France prior to the year 1700.

Among the early references to this apple as Fameuse, one is found in Forsyth's "Treatise on the Culture and Management of Fruit Trees," the first edition of which was published about 1800. Forsyth there records that this apple was brought from Canada by Mr. Barclay.

The first reference to the apple as De Neige or Pomme de Neige, occurs in American, as well as English, horticultural literature twenty or thirty years later. This name, meaning Snow Apple, was given in reference to the snowy whiteness of the flesh.

There was another apple cultivated in Europe as far back as 1628, which carried the name of Pomme de Neige. This was cultivated by the old fruit breeder, Le Lectier, and recorded by Leroy. Leroy said that this certainly was not the Pomme de Neige of Canada.

The European Pomme de Neige is catalogued by Diel, after whom the pear, Beurre Diel, is named, and it is certainly not the Canadian apple. Thus confusion had early arisen, and Hogg, as far back as 1851, tried to overcome the difficulty by calling it De Neige, saying at the same time, "This is not the Pomme de Neige of Diel."

On account of this confusion, but more on account of the fact that the apple is now universally known in its home of origin by its original

name, Fameuse, the Committee decided to recognise this name in preference to the French name.

At the 1913-14 meetings the following names were approved of:—

APPLES.

Cleopatra	London Pippin
Scarlet Nonpareil	Adam's Pearmain
King of Pippins	Dumelow
Jonathan	Rome Beauty
Cox's Orange Pippin	Peasgood's Nonsuch
Rymer	Yates
Shorland Queen	Lord Wolseley
Maiden's Blush	Duke of Clarence
French Crab	Statesman
Gravenstein	Shepherd's Perfection
Rokewood	Reinette de Canada
Pomme de Neige	Worcester Pearmain
Prince Alfred	Granny Smith
McIntosh Red	Lord Suffield
Twenty Ounce	Beauty of Bath
Lord Daly	Wealthy
Stone Pippin	Winter Strawberry
Alfriston	Warner's King
Lane's Prince Albert	Ben Davis
Perfection	Wagener
Lang's Best	Gascoigne's Scarlet
Champion	Sutton

PEARS.

Vicar of Winkfield	Glou Morceau
Le Lectier	Duchess D'Angouleme
Doyenne du Comice	Winter Nelis
Giblin's Nelis	Madam Cole
Winter Cole	Elizabeth Cole
Beurre Bosc	Beurre Capiaumont
Josephine de Malines	Howell
Packham's Triumph	Packham's Late
Beurre D'Anjou	Clapp's Favourite
Urbaniste	Beurre Superfin
Durondeau	Thompson's
Conference	Beurre Diel

In regard to fruit nomenclature, the following rules are considered by the Committee as urgent:—

1. That the names shall be as simple as possible.
2. That wherever possible, one word only should be used as a name.
3. Duplication of names, or names possessing strong similarity, is to be avoided.
4. That such words as "seedling" and "hybrid" be abolished from Australian pomology as far as possible.
5. That priority of name, naming or of origin, have preference wherever possible.

Next Meeting.—It was decided that the next Conference be held in Adelaide, South Australia, commencing on or about 15th April, 1918.

After votes of thanks to the Minister and Under-Secretary for Agriculture, N.S.W., for hospitality extended at Bathurst, the Conference closed.

THE POMOLOGICAL COMMITTEE OF AUSTRALIA.

Apples and Pears.

(Specimens and Information for Pomological Records.)

Section I.

The accompanying specimens of ....
were obtained from Mr. .... orchard ....
at .... grown on .... soil.

Average annual rainfall ....
Suggested name ....
Origin .... Age of tree ....
The original tree is still growing at ....
Age of tree from which samples were taken ....
Worked on .... stock.
Habits of growth ....
Description of bark .... leaf ....
Blossoming date ....
Cropping characteristics ....
Date of ripening ....
Keeping qualities ....
Subject to what diseases or pests ....
Any other information ....
Sgd. ....
Date ....

Section II.

(To be filled in at Head Office.)

Form ....
Size (in inches) .... high .... wide.
Colour of skin ....
Dots, markings, or russets ....
Eye .... Basin ....
Segments ....
Stalk .... Cavity ....
Stamens .... Tube ....
Core .... Axile .... Abaxile............
Flesh texture .... Colour ....
Flavour and quality ....
Used for dessert .... or culinary ....

COMMONWEALTH ADVISORY COUNCIL OF SCIENCE AND INDUSTRY.

EXECUTIVE COMMITTEE.

FIRST PROGRESS REPORT OF THE SPECIAL COMMITTEE ON THE DAMAGE BY INSECTS TO GRAIN IN STORE.

Prefatory Note.

As the result of certain proposals made early in the year 1916 by the Board of Agriculture, London, the Council of the Royal Society of England appointed a Committee to inquire into the damage done by insects to grain in store. It was thought that such an inquiry would be more fruitful if the insect pests were simultaneously investigated in the countries growing and shipping the grain. The Royal Society, therefore, decided to invite the co-operation of scientific institutions in Canada and Australia, and to ask for the assistance of the India Office.

After obtaining certain preliminary information on the matter from the State Government Entomologists of Australia, the Executive Committee of the Commonwealth Advisory Council of Science and Industry, with the approval of the Commonwealth Government, appointed on the 14th December, 1916, the following Special Committee to inquire into and report on the above question:—

Members of Special Committee.

Leo Rossell, Esq., The Great Western Milling Co. Ltd., Sydney, New South Wales, representing the Wheat Trade (chairman).

W. W. Froggatt, Esq., Government Entomologist, Sydney, New South Wales.

Professor W. A. Haswell, M.A., D.Sc., F.R.S., Professor of Zoology in the University of Sydney, New South Wales.

The terms of reference to the Committee were as follows:—"To consider the relative economic importance of the species and varieties of insects infesting grain, to suggest measures to combat them, and to inquire into the extent of the actual loss from these pests or into other aspects of this question in Australia."

Committee on Damage to Stored Grain by Insects.

PROGRESS REPORT.

In connexion with our inquiry into the subject of the destruction of stored grain by insects, we beg to present the following report:—

We have given careful attention to the reports on the subject received from the Government Entomologists of New South Wales, Victoria, Queensland, South Australia, and Western Australia.

A paper by F. J. Cole, published in the *Journal of Economic Zoology*, giving the results of experiments on the effects of moisture and carbon dioxide, in various proportions, on the active multiplication of the grain weevil, has been very useful as pointing to certain practical conclusions.

Much useful information has also been obtained from perusal of the copy of extracts from Mr. Noel Paton's report to the Indian Government on Indian Wheat and Grain Elevators, which your Acting Secretary was good enough to forward to us.

We have paid visits of inspection to the Darling Harbor Wheat Sheds, and to the Wheat Stacks at White Bay and Enfield.

At our request, Mr. Guthrie, Chemist to the Department of Agriculture of New South Wales, has determined the moisture content of samples obtained on these visits.

The present report deals only with the Grain-Weevils (*Calandra granaria and C. oryzae*), since these are the only insects attacking stored grain whose destructive effects are serious enough to demand special measures.

The Development of Weevil in Wheat and the Increase in Number of Weevils.

The wheat when bagged in the paddock has no weevil in it. It must come in contact with weevils after that before it becomes infested. This may happen in many ways. (1) Placing the grain in old bags which have been weevil infested, or in store sheds or granaries where there are weevil. (2) Weevils flying from grain stores, feed houses, &c., and working their way into the bags and sacks. (3) Using material in the construction of the foundations or the protection of the wheat stacks, wood, sleepers, old bagging, &c. (4) Bringing bags of weevil infested wheat in contact with or stacking near the sound wheat. There must be a female weevil to lay her eggs in a grain of wheat before that grain of wheat is weevil infested.

To the naked eye the grains may appear perfectly sound, as the minute hole into which the egg is inserted the grain does not show. It is when the egg has developed through the maggot, pupa, and perfect insect, and the latter has gnawed a hole through the side of the wheat grain, that the damage to the grain is evident. Not only do the weevils live and breed through their life cycle in the grains of wheat, but the perfect male and female weevils feed upon grain themselves, so that the damage is increasing all the time.

The life history from the egg to the adult beetle varies from 19 to 22 days in a warm suitable temperature. In three months 40 weevils multiplied themselves 60 times, and counted out 3,056 weevils.

Destruction of Weevils by Means of Poisonous Gases and by Drying.

The various methods of treatment by poisonous gases which have been tried either on an experimental or a large scale for the destruction of insect pests in grain, are not applicable to bagged grain, save at a prohibitive cost.

Fumigation with Carbon Bisulphide.

One thousand bushels of grain require 10 lbs. of carbon bisulphide, and require to be enclosed for 24 hours, with a temperature of 70 and not under 60. In badly infested wheat a second fumigation is required to get rid of the eggs and weevil inside grain about three weeks later. The cost of bisulphide is 7d. per lb., war rate.

Fumigation with Hydrocyanic Gas.

Experimented with this gas under similar conditions and temperature, and proved it to be not satisfactory, even with 48 hours.

Fumigation with Carbon Dioxide.

This is the most effective gas. 14.35 cubic feet of gas will submerge one ton of grain, and can be forced in at the bottom of the wheat or airtight silo. One pound, at atmospheric pressure, occupies a volume of 9 cubic feet, and would cost 3d. per lb. in large quantities. The total cost would be 4⅜d. per ton, and the gas could be used over and over again. Carbon dioxide runs to waste in distilleries.

Drying.

Wheat from thrashers averages 6.7 per cent. to 7.2 per cent. moisture.

When dried in the sun this is reduced to 4.7 per cent. In 4.7 per cent. and 6.7 per cent. of moisture, the weevil did not breed. With 8 per cent. moisture the weevils died in six weeks without breeding.

With 9 per cent. of moisture the weevils were dormant, and did not breed, but when more moisture was added they became active and bred.

With 10 per cent. of moisture the weevils bred, but required free air in order to breed with normal rapidity. Drying the wheat artificially or in the sun, and then storing in air-tight bins, is sufficient to prevent weevil from attacking it. If weevily wheat is held under the same conditions, the weevils die off. Moisture and a temperature of 80 deg. F., without moisture, is fatal. Deprived of oxygen, all weevils die within seven days.

Certain of the above described methods are employed in breweries and flour mills for ridding grain of weevils; but it is to be noted that in such cases the grain is treated in bulk, and has not to be re-bagged.

Destruction by such measures of the weevils and their eggs, when they have once seriously invaded the grain, being in the case of bagged wheat extremely costly, it is very important to inquire if there are any means of preventing such an invasion from taking place.

One obvious set of precautionary measures consists of measures for preventing weevil from gaining access to the grain. As has been already pointed out, wheat has no weevil in it when in the field*. In order that weevil may not gain access to it during carriage and storage it must not be packed in old bags which have become already tenanted by weevils, and it must be stored in such a way that weevils will not be able to reach it. Such precautions are difficult to carry out effectively in practice.

The grain-weevils are widely distributed and are very tenacious of life. Moreover, as already mentioned, a very small number gaining access to stored grain are able, if conditions are favorable, to multiply enormously in a comparatively short time.

Favorable and Unfavorable Conditions.

A study of the conditions most favorable to the multiplication of grain weevils, shows at once that temperature and moisture have to be considered before anything else. Both of these are, of course, capable of being controlled.

The experiments of F. J. Cole, Maxwell Lefroy, and others have shown that the presence of a certain degree of moisture in the grain is essential to the active multiplication of the weevils. This essential

* This does not hold good of maize.

percentage of moisture is a high one (10 per cent.) and when wheat is first bagged under ordinary circumstances, it does not contain nearly sufficient moisture to enable any weevils, however freely they may gain access to it, to increase and multiply.

Unless moisture is actually added from without, the grain remains weevil-proof. Thus if stored in a fairly dry climate, and completely protected from the weather, and from the absorption of moisture from the soil, it is perfectly certain that the grain may be stored indefinitely without danger from weevil.

The problem of the storage of grain in large quantities for more than a few months, has never had to be met in Australia until within the last few years. The prevailing methods of transport and of storage appear to be extremely crude and wasteful, and, what is to the present purpose, very favorable to the development of weevils. This (the presence of conditions favorable to the grain-weevils) holds good, more especially of the grain stored on the seaboard. There, even if the protection from the rain water were complete, there is reason to believe that with the moist air freely penetrating the mass of stored bags, the moisture absorbed, even with grain arriving dry, may soon reach the point which favours the rapid multiplication of the pest. But, unfortunately, this moistening of the grain is greatly accelerated by the prevailing methods of storage, which do not by any means afford complete protection from heavy rains. Even where, as at Darling Island, Sydney, the bags are stacked under galvanized iron sheds, the construction of the latter is such that during heavy rainstorms water finds its way freely into portions of the stacks. When this has once happened, either the whole mass of bags must be taken down, the wet grain dried and rebagged, and the whole re-stacked again, or, sooner or later, according to the temperature, weevil will flourish in the moistened grain and great damage will result.

When, as at White Bay and Enfield, near Sydney, the stacks are not under cover of sheds, but are built on a flooring of old sleepers, and are roofed over by sheets of galvanized iron, their sides being protected by bagging, the wetting of more or less of the grain is practically certain whenever a heavy rainstorm occurs, accompanied by a strong wind.

The losses through damage by weevils can be done away with, or, at least, kept within control, if the present system of handling, storage, and transport be replaced by bulk-handling.

Our conditions of wheat production in Australia are different from those in America and India. Our wheat lands are not yet compacted, but are broken up and scattered all over the States, making bulk-handling a difficult proposition both to the farmers and the railway authorities. The farmers strip or harvest their wheat into bags in the paddocks; the policy of the railway authorities has been to place a siding for the accommodation of the farmer wherever any area of land is under cultivation. The expense of re-organizing our present methods would be great, but it is imperative that it should take place if we are going to get the greatest value and the least waste in handling our wheat harvests. There is no reason why the farmers could not still continue to bag their wheat on their harvesters or winnowers. The bags could then be tied and transported to the nearest railway siding, and wheat emptied out of the bags into properly constructed silos, where it would be safe from rain, mice, and insect pests. There it could remain perfectly safe until the railway authorities, with properly constructed

trucks, could fill up and run it direct into the holds of the waiting grain ships. Under the present war conditions, it might have to be placed in gigantic receivers on the harbor frontages, and these permanent silos would do away with the expense of making the temporary stacks, which have cost large sums in material and labour.

It will be seen from the above that further information is desirable on several points, such as the following:—

1. The percentage of moisture in samples of harvested grain from all the chief grain-producing districts of the Commonwealth should be ascertained.

2. The degree and rate of absorption of moisture from the air of moist climates, by "dry" grain, completely protected from rain, but freely exposed to the air, should be definitely determined.

3. Cole's experiments on the effects of moisture and carbon dioxide on the rate of multiplication of grain weevils, should be repeated and amplified under Australian conditions.

To carry on such investigations, and any other that might suggest itself in the further progress of this inquiry, we would urge the desirability of engaging the services of a man having the requisite qualifications, and able to devote his whole attention to the work.

ROOTING DEPTHS OF PLANTS.

A study of the growth and development of the roots of plants is of practical interest. Certain systems of planting and cultivation have been practised, because experience has shown them to be the best, often without the reason being known. Study of the soil and of the roots of plants throws light upon some of the difficult problems of crop production, and leads to better farming.

Wheat and oats do not spread out their roots so far horizontally as do the roots of most other cultivated crops, but penetrate deeper into the soil.

Grass is a soil maker and a soil protector. No other crop equals the perennial grasses in producing such an immense growth of roots in the upper layers of the soil, and the roots of some varieties of grass also penetrate deep, being exceeded in this respect only by one other class of crop, the perennial legumes.

Lucerne is the deepest rooting plant of the cultivated crops. It makes only a small fibrous growth of roots in the upper soil, and is almost entirely a deep-feeding plant.

As a soil maker and improver no other plant equals it, because, in addition to the deep-root system opening up the soil and drawing supplies of mineral food from the lower layers, the plant by the assimilation of nitrogen through its roots enriches the soil in this invaluable ingredient and is thus a soil enricher.

The study of potato and sugar beet roots suggests the necessity of a deep stirring of the soil in preparing a seed bed for planting these crops. The root system of the potato indicates that the plant, although requiring a thoroughly cultivated soil, feeds near the surface, while the tap root of the sugar beet penetrates more deeply.

Such observations as have been made on the roots of trees seem to indicate that the root systems vary considerably, and the observations may lead to the suggestion that certain trees would be better than others for planting alongside roads and in cultivated fields.—*Agricultural News*, Durban, 15th March, 1917.

AUSTRALIAN FODDER SHRUB.

THE SALT BUSH.

(By *J. W. Audas, F.L.S., Assistant, National Herbarium, Melbourne.*)

The Victorian farmer, rarely troubled by successions of bad seasons or droughts, such as distress his compatriots in the Northern States, generally has abundance of grasses to feed his stock, and does not, therefore, turn his attention to the many native fodder plants and shrubs in which this continent is so rich. He knows them not by sight, and their names are by him yet unlearned. This fact is to be regretted, for let the supply of grasses be ever so abundant, the shrubs are still useful, for they supply medicinal wants of stock, and, being green and tender during the hot summer months, when grass is dry, they form a healthful change of diet.

These fodder plants (non-grasses) are very numerous. To mention a few there are the "Lightwood," *Acacia implexa;* "Willow Acacia," *A. salicina;* Sugar Gum, *Eucalyptus, (corynocalyx) cladocalyx;* "White Wood," *Heterodendron oleaefolium;* "Wilga," *Geijera parviflora;* "Kurrajong," *Brachychiton populneus;* "Weeping Pittosporum," *Pittosporum phillyrœoides;* Sweet Bursaria, *Bursaria spinosa;* Wormwood Cassia, *Cassia artemisioides;* Desert Cassia, *C. eremophila;* Rock Cassia, *C. desolata;* Berrigan, *Eremophila longifolia;* Spotted Emu Bush, *Eremophila maculata;* Twin-leaved Emu Bush, *E. oppositifolia;* "Turkey Bush," *Myoporum Deserti;* "Quandong," *Fusanus acuminatus;* Black Sheoke, *Casuarina suberosa;* and Drooping Sheoke, *C. quadrivalvis*, but probably the best of all are the Saltbushes. Of the latter Australia has 137 species, arranged under fifteen genera, and Victoria claims sixty-six of these species native to her own soil.

The accompanying table shows the distribution of indigenous genera and their relative strength in species over the various States of the Commonwealth.

Genera.	Western Australia.	South Australia.	Tasmania.	Victoria.	New South Wales.	Queensland.	Northern Territory
Hemichroa ..	2	3	..	2	2	..	1
Atriplex	15	22	3	15	18	14	11
Rhagodia ..	10	7	2	7	8	7	4
Chenopodium ..	7	9	1	9	9	8	4
Dysphania ..	2	2	..	1	1	1	2
Kochia	17	18	..	13	17	14	4
Didymanthus ..	1	..	..	..	..	..	1
Babbagia ..	..	3	..	..	2	3	2
Bassia	15	17	..	11	14	14	8
Threlkeldia ..	1	3	1	2	3	1	..
Enchylæna ..	1	1	..	1	1	1	1
Pachycornia ..	1	1	..	1	1	..	1
Salicornia ..	6	4	2	2	4	5	4
Suæda	1	1	1	1	1	1	1
Salsola	1	1	..	1	1	1	1

All varieties of saltbush are very tenacious of existence, and some positively defy the elements of drought, the drier the season the more

green and luxuriant becomes their growth. To one enemy do they succumb, and that is the pastoralist who overstocks his land. But for this greed he loses tenfold, as it is well known that stock thrive in drought periods on land where salt plants abound, besides escaping many diseases, while animals pastured on lands where salinous plants have been eaten out, frequently die of starvation.

Pastoralists would be well repaid if they were to re-disseminate the saltbush on their lands where it has been eaten out, or to cultivate it on parts where it was previously unknown. The great variety of species and their extreme hardiness lend themselves well to these general propositions, as plants could be found which would thrive in any climate, and on almost any soil. For instance, *Rhagodia Billardieri* and *Atriplex cinerea* would thrive well on the barren, wind-swept ridges of the coast. *Kochia sedifolia*, the famous Australian Blue Bush, would flourish in most arid districts, but its drought-resisting qualities are closely rivalled by its relatives, the Cottony Saltbush, *Kochia lanosa*, and Grey Bush, *K. pyramidata*. The latter plant is found principally near the Murray River in Victoria, and like many of its congeners, it affords excellent pasture-fodder.

Analysis of *Kochia pyramidata*, Benth.—"Grey Bush."

In the proceedings of the Royal Society of New South Wales, 1880, p. 133, Mr. W. A. Dixon gives the following analysis of this plant:—

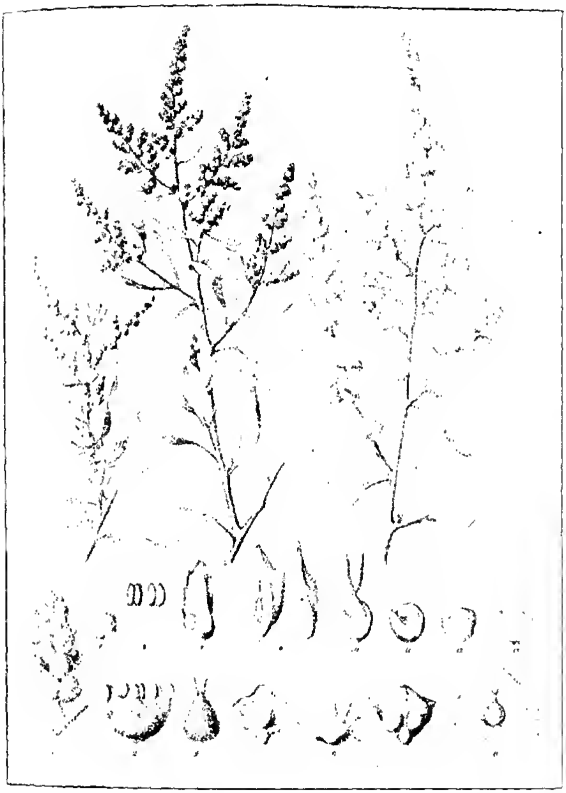
	%
Oil	2·14
Carbohydrates	32·63
Albuminoids	19·94
Woody fibre	8·04
Ash CO_2	37·25
	100·00
Nitrogen	3·19
Woody parts of plant	37·
Edible parts of plant	63·

Ash Analysis.

——	On Ash.	On Plant.
	%	%
Potash	12·39	4·62
Soda	34·43	12·83
Chloride of sodium	26·67	9·93
Lime	8·75	3·26
Magnesia	7·32	2·72
Ferric oxide	1·28	·48
Sulphuric oxide	1·11	·41
Phosphoric oxide	3·98	1·48
Silica soluble	4·07	1·52
	100·00	37·25

Probably one of the best saltbushes is the half-berried Atriplex (*Atriplex semibaccata*), a procumbent, many-branched plant which spreads in a dense mat on the ground, and which could be grown indiscriminately. One plant will often cover an area the size of a cart

wheel, and from its tender green colouring and oblong-lanceolate leaves, is often supposed to be a grass. It seems specially adapted to flourish in the strongest alkali soil, but like all the saltbushes, it will grow



Atriplex mummularia.

Lindley in Mitchell's *Tropical Australia* (1848).

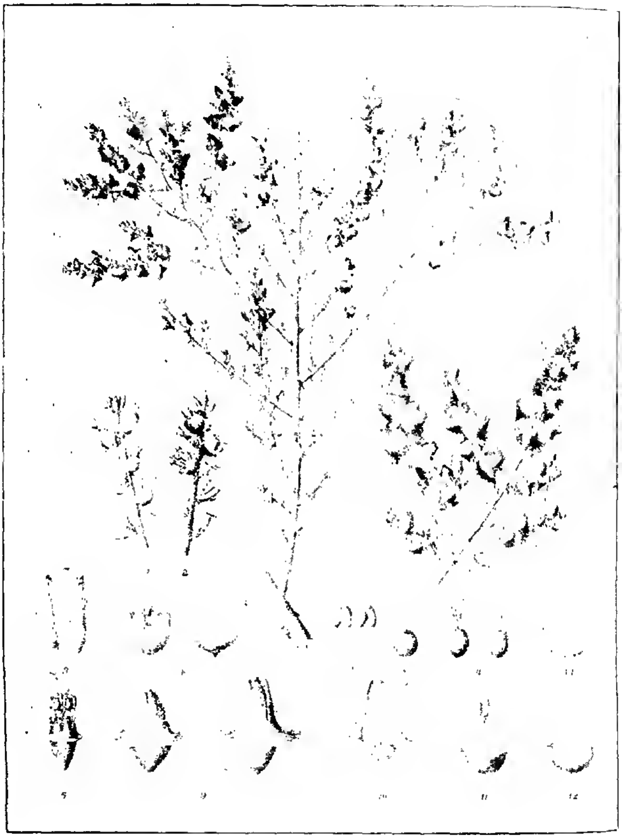
1. Portion of a branchlet with unexpanded staminate flowers.
2. An expanded staminate flower.
3. Front and back view of a stamen.
4. Pollen grain.
5. A pistillate flower.

6 and 7. Fruit-bearing calyces.

8. A fruit-bearing calyx—one-half of it removed.
9. Longitudinal section of two fruit-bearing calyces.
10. A fruit—separated.
11. A seed.
12. Transverse section of a seed.
13. Longitudinal section of a fruit.

All enlarged, but to various extent.

almost anywhere except on swamp land, and endure great heat and drought. It is, however, rather sensitive to frost, and will only withstand a moderate amount of that element. *Atriplex mummularia*,



Kochia pyramidata.

Bentham, *Flora Australiensis*, v. (1870).

1 and 2. Portion of two branchlets with leaves and flowers.
3. Portion of two leaves.
4. Two flowers.
5. A flower in a more advanced state.
6. Front and back view of stamen.
7. Pollen grain.
8. Two flowers far advanced—one with half the calyx removed.
9. Two fruit-bearing calyces.
10. Vertical section of a fruit with its calyx.
11. A fruit, the calyx removed.
12. A seed.
13. Horizontal section of a seed.

All enlarged, but to various extent.

Lindl., the so-called "Old Man Saltbush," is a shrub which often attains a height of from 6 to 12 feet, and is considered to be one of the tallest, most fattening, and wholesome of Australian pastoral saltbushes. Stock of all descriptions are fond of this plant, cattle particularly so, and they often eat it so closely down that it has little chance to recuperate. When left unmolested for a time, however, it quickly recovers and produces seed in fair quantities, which, when ripe, germinates readily under ordinary conditions.

Analysis of *Atriplex mummularia*, Lindl.—"Old Man Saltbush."

In the proceedings of the Royal Society, New South Wales, 1880, p. 133, Mr. W. A. Dixon gives the following analysis of this plant:—

	%
Oil	2·18
Carbohydrates	42·85
Albuminoids	16·45
Woody fibre	7·24
Ash CO_2	31·28
	100·0
Nitrogen	2·63
Woody parts of plant	10.
Edible parts of plant	90.

Ash Analysis.

—	On Ash.	On Plant.
	%	%
Potash	15·69	4·91
Soda	29·57	9·25
Chloride of sodium	30·28	9·47
Lime	8·65	2·71
Magnesia	6·77	2·12
Ferric oxide	·64	·20
Sulphuric oxide	3·17	·99
Phosphoric oxide	4·11	1·28
Silica soluble	1·12	·35
	100·00	31·28

On nearly every farm, no matter how well managed, there is always some small patch which does not seem to grow anything. If planted with saltbushes, it will not long remain unprofitable. Strips along fences might be planted to form hedges, using the taller growing kinds, such as *Atriplex mummularia* or *Rhagodia hastata*. These shrubs may be raised from cuttings or by planting the seed lightly by the use of a hoe. The latter is a really beautiful shrub with silvery white leaves, and bears clusters of red berries. Mr. W. A. Dixon found the proportion of saline substance in this plant very large.

Practical Hints and Suggestions.

Reserves might be made from which an almost inexhaustible supply of fodder couuld be cut, and it might be found better to conserve it in this way, as, while the plants will stand any amount of cutting, they are frequently exterminated by the injuries caused by the animals hoofs, if stock is allowed to enter the reserves. If it is desired to grow them in

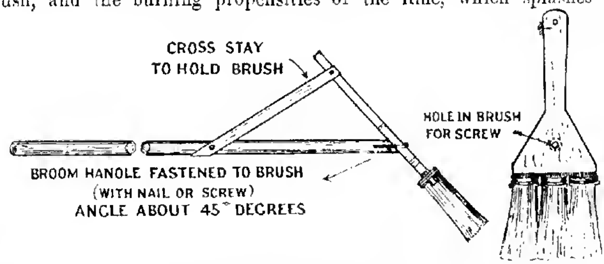
open paddocks, a light covering of prickly branches will safeguard the plants from animals, until they have become sufficiently established. Cuttings of half-ripened wood, about a foot long, may be placed in the ground in the ordinary way during the spring or the autumn months, when the soil is moist. Nearly all the varieties can be multiplied by cuttings, but if it be preferred to use seed, it should be sown in patches, and in distances varying according to the variety sown. Taller sorts about 30 feet apart, and for smaller sorts about 10 feet.

In heavy soils it would be advisable to cover the seeds with light loose sand and decayed leaves, so as to offer no resistance to the young shoots. It is practically impossible to get satisfactory results by sowing broadcast, because the seeds, being so light (of some it would take about 20,000 to weigh a pound), they would be blown away by the wind and wasted. There is an old saying that "the longest way round is the shortest way there," and probably the more troublesome method, that of raising the seed in prepared beds and transplanting when large enough to handle, would be found to give the best results eventually.

LIME WASHING OF COW BYRES.

By J. J. Ricketts, Dairy Supervisor.

The first essential in the production of clean milk is that the milking shed must be kept sweet and sanitary. This may be done at a very small outlay by the use of lime wash. Such attention will also help to keep down flies, which tend to make cows very restive during milking time. In the majority of sheds, the walls only are lime washed, while the inside of the roof is left free to harbor cobwebs and dust, which accumulate to an amazing degree. The roof is no doubt left untouched because of the difficulty of applying the lime wash with an ordinary brush, and the burning propensities of the lime, which splashes the



operator. A very handy appliance, as shown in the accompanying illustration, has been devised by a metropolitan dairyman to overcome this difficulty. It consists of a worn-out broom handle, to the end of which an ordinary whitewash brush is nailed, and supported by a cross-stay from the broom handle to the handle of the brush. By the use of this device the liquid, instead of falling on the operator, runs down the brush, and does not reach the hands of the operator, as happens when a short brush is used.

THE POULTRY INDUSTRY.*

By A. V. D. Rintoul, Assistant Poultry Expert.

"If everybody does his duty patriotically, and contributes each in his own way to the common stock, then I say the submarine menace is not going to defeat us."

These stirring words, recently uttered by the British Prime Minister, may well be applied to such an important rural industry as poultry breeding. The terrible drought and the world-wide war have brought about a serious depletion in our flocks and herds—a loss which may be considerably remedied by an increased production of eggs and poultry flesh. This is a matter that should be brought home to every householder in the Commonwealth. There must be some scraps available always to help reduce the feed bill—scraps that would otherwise be wasted; whilst our enemies are wasting nothing, and in England a woman has been fined £5 for wasting a loaf. A very important point to suburban householders is the regulation that fowl sheds should be not less than 25 feet from the nearest dwelling, and it must be equally made clear that the words "If convenient" follow. Regulations must be made for health purposes, but they are purely for health purposes, and in no way intended or desired to interfere with the prosperity of the State.

Poultry keeping in America is the greatest money producer of all rural industries, the return from 1915 being seven hundred million dollars, fully 50 per cent. more than the wheat yield; whilst in Victoria the industry last year was worth about £2,000,000, or roughly 30s. per head of the population. The stud breeders of Australia stand second to none throughout the world, and all world's records are held by Australian breeders. It is a matter for surprise that more people do not in consequence pay attention to the possibilities in this direction. Realizing and fully acknowledging that, except in the case of skilled professionals, the industry is best developed in conjunction with some other business, rural or otherwise, there is still a vast scope for increasing the national wealth, whilst, after the war, the prospects are practically unlimited.

A vast number of fowls were kept and a huge export of eggs developed in Austria and Southern Hungary: Russia, France, and Italy also were great poultry raisers. What is their position now? Geese were quoted in the press £7 10s. each at Christmas in Vienna, eggs 10s. a dozen retail in England, wheat recently 13s. 6d. a bushel in Chicago. Everything points to a world shortage of breeding stock which, after the war, may be replenished from the heaviest laying stock in the world—the Australian record layers. At present a team of six White Leghorn pullets have laid 1,699 eggs in a year, an average of 283 per bird: a team of Black Orpingtons has laid 1,596, an average of 266 per bird: whilst in single test competitions White Leghorns have laid 315, 313, 309, and 302. Black Orpingtons in single test have laid 312, 309, 307, and 298, which shows that there is but little to choose between them, whilst other breeds, by continued careful selection, could doubtless be developed to an equally high standard of perfection: There is, however, little doubt that the teams competitions have now more or less served their

* Read at the Annual Convention of the Chamber of Agriculture, Bendigo, July, 1917.

purpose, and are likely to gradually give way to the single test competitions. For example, a team puts up a score of, say, 1,350—an average of 225 eggs per bird—which, although satisfactory and distinctly profitable from the monetary aspect, scarcely gives a clear indication of the actual merit of the birds. The individual score of the birds may perhaps have been as follows:—274, 269, 248, 243, 176, 140. Now, breeding from these as a team, it is quite as likely that a cockerel may afterwards be used for breeding purposes from the 140 hen as from the 274 hen, with consequent serious loss; whereas the individual scores being known, cockerels can be saved from the highest producing dams, and the poor layers discarded. With something like four million birds in this State, an increase of but six eggs per annum per bird, at only 1s. per dozen, represents an increased revenue of £100,000; consequently the urgency of careful selection and mating cannot be overestimated. Why are milk records kept? Why does the Department of Agriculture sell young bulls on the proportionate basis of the dam's record? The answer is because the unprofitable stock should be culled out, so that the average production of the herd may become greater, more profitable. From the national point of view the ulterior object of the laying competitions is not to establish a record, nor to enrich the successful, and perhaps occasionally lucky, winner, but to determine the capabilities of the best birds, so that their progeny may raise the flock average number of eggs per bird throughout the State. No one can foretell the state of affairs after the war; but if long lean years lie ahead, the necessity must be greater than ever, not merely to increase capacity, but at the same time to increase the average yield. With increased production must come co-operation to secure a better system of marketing. Quite recently poultry keepers in a leading country town were getting 1s. 6d. a dozen for their eggs, others, according to their luck, were being paid 1s. 7d. to 1s. 9d., with "special suburban" new laids quoted at 1s. 10d. At the same time many retailers were scouring the suburbs to secure eggs at 2s., and they could not be obtained from shops in a seaside suburb under 2s. 5d. or 2s. 6d. These facts speak for themselves. Business is business, and admitting that there should be a fair margin of profit for the middleman, it should only be a fair margin. Co-operation is far harder in a big country with a small population than in a congested small area. At the same time, despite this, difficulties must be faced, and no stone left unturned to increase the wealth of the country in her hour of need.

WHERE THE DAIRYMAN'S PROFITS GO.

By J. J. Ricketts, Dairy Supervisor.

Careless work on the part of dairy farm employees may inadvertently result in much loss to the owner of the cattle. Particularly in the operation of milking is it essential the work should be done both thoroughly and as speedily as possible, otherwise there will be a definite loss in the quantity of milk obtained from the cows, and its quality will be adversely affected. Cows give their milk more freely when the milking is done quickly by a practised hand, and the last pint or so is

much richer in butter fat than the bulk of the yield. Further, if a cow be not thoroughly "stripped" at each milking there is a tendency on the part of the animal to give a smaller quantity at subsequent milkings. Nature provides that the cow should give sufficient milk to supply the wants of her calf, and if the udder be repeatedly sucked dry, there is an inducement for her to produce more milk. If the quantity available for the calf be not used by it, she gradually gives less, until the demand and the supply are more nearly equal. Thorough milking thus makes for greater production, while leaving milk in the udder will gradually reduce the yield. When, therefore, thorough milking is absolutely necessary to obtain both the full quantity and quality of each cow's milk, it is obvious that the owner, who neglects to give proper attention to the milking operation, will not obtain the maximum yield.

Not infrequently is the statement made that dairy herds give milk of much poorer quality in the spring time than during other seasons. Where the bulk of the cows in a herd are freshly calved, and have thus not reached their normal quality of milk, while yet giving a heavy bulk yield, there is a possibility of the quality not being quite what is desired. In many instances, however, it will be found on investigation that the milking operation is not being carried out properly, and that in consequence the quality is low. In the spring flush, milkers are frequently careless about stripping each cow, and, there being a large bulk yield from the herd, the owner may not suspect that it might possibly be still larger, and the price obtainable does not encourage him to try to improve it. But as the season advances, and the grass is drying, with a consequent reduction in the milk yield, and the price at the same time increasing, a little inquiry or supervision by the owner is likely to result in the cows being stripped out better, and the quality of the milk thus increased. Where several milkers are dealing with a large herd of heavy milkers there is too often a tendency to finish each cow as soon as possible, and to hear of men milking from fourteen to seventeen cows per hour is not at all unusual. When it is considered that this allows about four minutes per cow, in which possibly more than 10 quarts has to be taken, and that the milker has to transfer this quantity to a receiving can and move to another animal, it will be recognised that very little attention can be given to the work of stripping, and therefore the milk richest in butter fat globules is possibly not taken from many cows for days together. On one occasion after placing this aspect of the milking work before a dairyman, he promised to look more closely into the matter, and later informed me that the result was far beyond even what I had given him to understand as possible. In fact, his increased return for one week was exactly 56 lbs., or one box of butter. This demonstrates that a little oversight may put quite a different view on the financial side of dairy work. It also suggests that an extra fast milker may perhaps not be a very desirable acquisition on the farm.

At one time, in the course of a dairy herd inspection during milking time, I handled 53 cows after they were milked, and not one of these had been properly stripped, several of them having over a pint of milk still in the udder. In a herd of this size even a pint per cow left

unmilked would result in a bulk loss of some 6½ gallons, and as the price at the time of my inspection was high, viz., 1s. 10d. per gallon, there was a monetary loss of well over £8 on the week's work. It would be a particularly good dairy herd that could stand such a leakage. This is no unusual occurrence, and indifferent milking is one of the commonest causes which make the dairy farmer say that his cows "are doing no good." The Department of Agriculture has constantly advocated the weighing and testing of each cow's milk as one of the most essential features of dairy farm management, and the farmer who follows this advice is running no risk of his cows not being milked properly. This tests acts as an alarm bell to point out any falling off from the normal milk yield. It enables the owner to get rid of all cows that are "not worth their salt." It is an indisputable report on those cows which are to produce stock for future dairy work. In short, systematic weighing and testing of milk yields is the key to profitable dairying, and no dairy farmer can afford to forget it.

SOME OBSERVATIONS OF THE DROUGHT ON OUR WESTERN BORDER.

By F. R. Temple, Inspector of Stock.

That a drought has beneficial effects is a statement requiring qualifications. However, in districts where fluke and worms are found in stock, especially young sheep, there is no doubt that a dry season brings advantages to compensate for the losses it inflicts. Yet seldom does an opportunity occur of noting the marked difference in the condition of lambs and two-tooths consequent on a period of drought as has been afforded during the past two years on some of the station properties on our western border, previously noted for the difficulty experienced by the proprietors in the rearing of sheep. In a couple of typical holdings which I have known for many years, the land, prior to the drought of 1915, was not without swamps, which acted as a favorable situation for reproducing animal parasites. This drought, however, dried out all these water lodgments in the whole district—a state never before known to the white man—and since then the animals reared on these holdings have been singularly healthy, and equal to any from areas where fluke and worms are unknown. When the swamp waters were failing on these stations subterranean supplies were sought, and, whether instinctively avoiding the disease-producing swamps or from preference for the underground supply, it would be hard to determine, but the sheep soon passed the swamp by and went to the troughing for water. At any rate, the circumstances have proved that without the swamps the stock on these properties are free from internal parasites which formerly affected them.

Many will naturally be inclined to ask whether this benefit outweighs the losses sustained. To this question I reply that we must

take the seasons as they come, and stock-owners should always be prepared for a long spell of dry weather. If this foresight be shown that which usually seems an evil may perhaps be regarded as a blessing.

During the drought years 1914-15 one grazier near the western border lost fully one-half of his sheep, as well as other stock, whilst the losses of a neighbour were comparatively small. The secret of these small losses was that the latter had made provision in case of an abnormally dry season, and he was able to allow his sheep half-a-pound of oats per day per head, and on this they fully held their own in condition. This grazier produces his own oats for his sheep, which number thousands, and this year, although feed is plentiful, oats are stored for future sheep feed, and are not for sale.

Before concluding these observations I should like to refer to the great destruction of many of our wild-fowl by so-called sportsmen. Duck and other swamp-frequenting birds are natural enemies of both flukes and worms, and they should be protected to the utmost.

The tapping of subterranean waters to replace the supplies of exhausted swamps has revealed several hitherto unknown properties under the soil. In one place on the border of South Australia water of a saltiness approximating that of sea water was met, the presence of which was not previously suspected. The high agricultural value of many of these swamp areas when dry has also been established, and no doubt in the future will be a source of wealth to the State, especially as some of them could be cheaply drained.

ORCHARD AND GARDEN NOTES.

(E. E. Pescott, F.L.S., Pomologist.)

The Orchard.

If the winter spraying has been delayed, it should be completed as quickly as possible, and before the buds begin to swell and burst.

It is not advisable to spray the stone fruits with the red oil emulsion at this time, as there will be danger of burning and destroying the early buds that may be swelling, and consequently loosen their outside scales. It will be safe, if the work be done at once, to spray apple, pear and quince trees with this spray, especially where the Bryobia Mite, scale insects, or woolly aphis are prevalent.

If it is intended that the lime-sulphur wash be the specific for these and other pests, it may be used with safety, although the spraying should be completed as early as possible. This mixture has a certain value as a fungicide, and it is well worth trying on peach trees that have been affected with the leaf curl; more especially in view of the fact that in some districts severe burning has occurred in peach orchards as a result of using Bordeaux mixture late in the season.

Where peach aphis has appeared, it will be advisable to spray at once with a strong nicotine solution. Tobacco stems should be soaked in cold water for some days, adding a teaspoonful of caustic soda to a cask of steeping stems. The liquid should be made strong, and every endeavour should be made to kill out the first insects that appear.

The pruning of deciduous trees should be at an end this month. The pruning of evergreens such as oranges, lemons, and guavas, may be left until later.

Young deciduous trees should be planted not later than this month. The soil should be trodden firm round the roots, and, when planting has been completed, the tree should be headed back to three or four buds on each arm.

Preparation may be made for planting citrus and other evergreen trees. The soil should be well ploughed and sweetened in anticipation of planting in September and October.

In root-borer affected districts, the beetles will begin to appear during the latter part of the month. A close observance should be kept on them and the insects should be regularly collected and destroyed.

Flower Garden.

All winter-flowering shrubs that have dropped their blossoms may now be pruned. It is important to prune these immediately after flowering, so that the plant may be able to make plenty of flowering wood for next season.

Seed beds and plots need constant cleaning and weeding. Weeds must now be kept out of the garden, both by hoeing and hand picking. The seedlings that are growing in their permanent situations should be thinned out and given a good chance to develop strong and sturdy plants.

Divisions of herbaceous plants such as delphiniums, cannas, shasta daisy, herbaceous chrysanthemums, rudbeckias, salvias, and phlox, may be still planted out. If it is intended that such plants shall remain in the same location as last season, they should be lifted, the soil being well dug and manured, and the crowns planted back again. By this means the plants retain their vigour, and are able to produce good flowers each season.

Evergreen shrubs may now be planted out, the soil having previously been well dug and aired. All beds should be well dug over by this time, manure and refuse litter having been dug into the soil.

A few corms and tubers of early summer flowering bulbous plants may now be planted.

Vegetable Garden.

The plots should be well dug over at this time, adding gypsum or lime where any pests have been prevalent. In other beds stable manure should be well worked into the soil.

The soil should be rich, well worked, and warm, so that a quick growth may result. Vegetables grown quickly are generally more tender than slowly grown ones; and frequent changes of crops in the plots will give better results. At this season, the weeds will require constant checking; frequent use of the hoe will, therefore, be necessary, and in the rows hand-weeding should be resorted to.

All seedlings should be planted out, especially seedlings of cabbage, cauliflower, lettuce, and onion. Seeds of peas, carrots, parsnips, radish, lettuce, tomato, and broad beans may be sown.

Where they can be sheltered and protected from frosts, young tomato plants may be planted out for early fruiting. One method of managing these early plants is to place the young plant a few inches below the surface, and then a box, 8 or 9 inches deep, with top and bottom removed, over the plant at ground level. This can then be covered loosely with a piece of glass whenever necessary.

Potatoes, artichokes, and asparagus crowns may be planted. Asparagus beds should be kept free from weeds; they should have a loose surface, and a light top dressing with old manure would be beneficial.

In the frames, cucumber, vegetable marrow, melon, pumpkin, water and rock melon seeds may be planted. These are best planted in pots placing three or four seeds in each pot. They then suffer no check when being transplanted into beds.

REMINDERS FOR SEPTEMBER.

LIVE STOCK.

Horses.—Still continue to feed stabled horses well; feed green stuff if available. Continue rugging to encourage the shedding of the coat; good grooming will also be beneficial. Continue giving hay or straw to grass-fed working horses. Feed old and badly-conditioned horses liberally. In foal mares due to foal early, if worked, should be turned out to paddock. Feed stallions doing stud duty liberally. Equivalent amount of cracked Indian corn (maize) may with advantage be substituted for oats, if latter grain is scarce.

Cattle.—Cows should still be rugged, but coverings should be removed frequently, in order to enable the animal to get rid of the old coat; or, better still, a good curry-combing may be given. Continue hay or straw. Look up treatment for milk fever in *Year-Book of Agriculture*, 1905, and treat cattle accordingly. Give calves a good warm dry shed. Give the milk to young calves at blood heat. Have feeding troughs or buckets clean. Don't over-feed. Feed regularly with regard to quantity and time. Provide a good grass run, or fine hay or crushed oats in a box or trough. Give a cupful of limewater per calf per day in the milk. The problem with many at the present time is how to rear calves without milk. This can be done very well by starting them on new milk for a fortnight, and then gradually substituting the milk with one of the calf meals on the market. To these it would be advisable to add two or three tablespoonfuls of cod liver oil. The following meal is in general use in Ireland:—Two parts, by weight, of oatmeal, 2 parts maize meal, 1 part pure ground linseed, all finely ground. Scald with boiling water, and allow to stand for twelve hours. Start with new milk, then gradually substitute skim and $\frac{1}{4}$ lb. daily of the meal mixture per head per day, gradually increasing to 1 lb. or more. In a month milk may be dispensed with altogether. The crushed oats, fed dry, have been found to give excellent results.

Pigs.—Supply plenty of bedding in warm well-ventilated sties. Keep sties clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. If pigs are lousy dress with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect sties. Considering the present high price of pork, there should be a good margin of profit in fattening pigs. Worms are very prevalent at present, and may be treated by giving 2 to 10 grains of Santonin in form of pill, or from half to one teaspoonful of oil of turpentine in milk or castor oil.

Yard and go through all well-bred Merino-Lincoln cross lambs before offering to exporters. Select, ear mark, and shear all best sorts for future breeding and shearing. Buyers will find shafty, well bred, fine to medium grade wools, disappointingly scarce for years.

SHEEP.—Wherever early shearing is possible, and shelter available, all sheep to be disposed of can be fattened earlier, if shorn. Sheep or lambs not good enough for freezing also thrive better after being shorn. Where insufficient knowledge of grading cross-bred wool exists, draft the coarse sheep from the fine before coming into the shed, and shear and bale separately. Clean all daggy sheep before bringing them on to the shearing board. Avoid deep and careless skirting. Only dense seedy parts, and heavy fribs and stains should come off fleeces. Press in a box press, which forms square sides to bales, and avoid round bales, called "Sew Downs." Brand boldly and neatly on the long and narrow side. Clean carefully all straw, chaff, &c., from shearing place. Cut back all misshapen feet when noticed during shearing.

POULTRY.—September is one of the best months for hatching for winter eggs. Incubators should be kept going, and broody hens set. Care must be taken to keep down vermin, as they now breed quickly; use sprays in houses and Insectibane or Izal in nests—nothing stunts chickens quicker than vermin. The food for young chicks should be fine oatmeal, stale bread crumbs or biscuit meal, a little calcined bird's grit, a little chopped green stuff such as lettuce, thistles, or green lucerne or spring onions occasionally cut fine is a good tonic, and a pinch of powdered charcoal. Slightly moisten with new milk. Make the whole friable, and feed frequently ("little and often") just as much as they will readily eat, as an excess of food only sours and disturbs their digestive organs. Animal food may be given in small quantities after the first ten days once or twice a week. Chickens should be protected from damp ground and the cold, bleak winds.

CULTIVATION.

FARM.—Plant early potatoes, and work up fallow for the main crop. Keep fallow for summer forage crops well worked up with the disc and harrows. Make early sowings of mangolds, beet, field carrots, and turnips. Push on with the fallowing in the Northern Districts. Prepare land for tobacco seed beds by burning rubbish on the site; afterwards work up to depth of three or four inches.

ORCHARD.—Commence spring ploughing; plough in leguminous crops for green manure as soon as the plants are in full flower. Finish grafting early in the month. Spray peach and apricot trees with Bordeaux mixture as the blossom buds are opening, as a preventive against "leaf curl" and "shot hole" fungi; watch for peach aphis, and spray when present with tobacco solution.

FLOWER GARDEN.—Cultivate and work up the surface to a fine tilth—clear out all weeds. Water newly-planted shrubs, &c., if the weather is dry. Plant out cannas, early dahlias, chrysanthemums, gladioli, and other herbaceous plants.

VEGETABLE GARDEN.—Plant out seedlings. Sow seeds for summer use, such as tomatoes, cucumbers, marrows, pumpkins, melons, &c. Plant out tomatoes, and shelter till frosts are over. Hoe and work up the soil surface.

VINEYARD.—Plantation of young vines (grafted or ungrafted) should be concluded before the commencement of September; pruning of old vines likewise, as well as tying down of rods on long-pruned vines. Prune recently-planted vines just before buds commence to swell (if not pruned when planted), cutting strongest cane back to two buds. Do not delay this work until buds have shot, as this seriously weakens the young vine. Field grafting may be carried out, if weather be fine and warm. If cold and wet, postpone until October. Swab with acid iron sulphate vines which showed signs of Black Spot last season. To avoid burning, this must be completed before the buds commence to swell. (See article in July issue.) Cultivation (scarifying or discing) must receive attention when soil is in suitable condition.

Cellar.—Conclude spring racking early in month, if not already done. Fill up, regularly, all unfortified wines.

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STANDARD COWS.

Fifth Annual Report on the Testing of Pedigree Herds, conducted by the Department of Agriculture, Victoria, for the Year ended 30th June, 1917.

By W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer.

It is pleasing to record, in submitting this Fifth Annual Report, that the pedigree herds undergoing Government test are increasing in number. Practically all those breeders who entered their herds at the initiation of the scheme still find that it is a profitable investment, which in addition yields educational benefits, and the interest in the returns is maintained as keenly as ever.

Two new breeders have come forward during the past quarter, viz., Messrs. Cullis Hill and Doake, with Jerseys; and Mr. J. Baker, of Geringhap, with Red Polls.

That Ayrshire breeders have not seen fit to strive for standard honours in larger numbers is to be regretted. By submitting their herds to an official test the claim that the Ayrshire is the best breed of dairy cattle could be substantiated or otherwise by records that are reliable. It is anticipated that during the coming year a few more herds of this breed will enter the lists and show whether the laurels which it claims by virtue of its reputation can be retained in open competition.

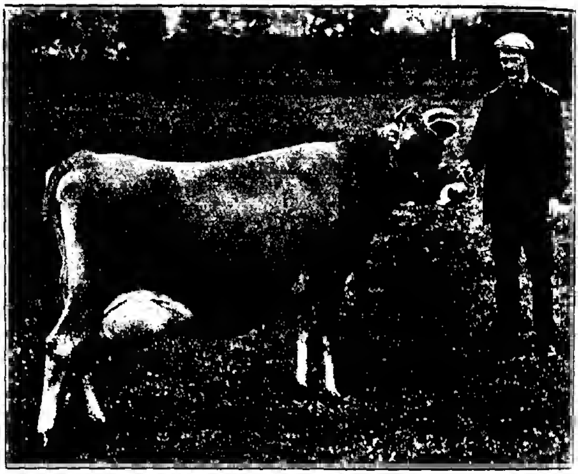
Twenty-four herds are now under the test, comprising 18 Jerseys, 4 Ayrshires, and 2 Red Polls. Two hundred and sixty-five cows completed their 273 days' term during the year, the three breeds being represented by the following numbers:—

Jersey	190
Red Poll	44
Ayrshire	31

Of these, 176 Jerseys, 20 Ayrshires, and 38 Red Polls, by obtaining their certificates, become standard cows.

There is one fact in connexion with these tests upon which too much stress cannot be laid—it is that the yields recorded are obtained under perfectly normal conditions of every-day farming. No forcing or attempting to put up fancy records at the expense of constitution is indulged in, and at no time have the officers engaged in the collection of samples and checking of weights found feeding of any other kind than that which should be carried out on every dairy farm. In support of this contention a study of the yields during the past five years will show the general consistency which could not be maintained under any other circumstances.

The Red Poll cow "Muria," of the Werribee Research Farm, is again first on the list in order of merit, with a yield of 9,993 lbs. of



Mercedes Noble Queen (imp.). Owner: Mr. C. D. Lloyd.

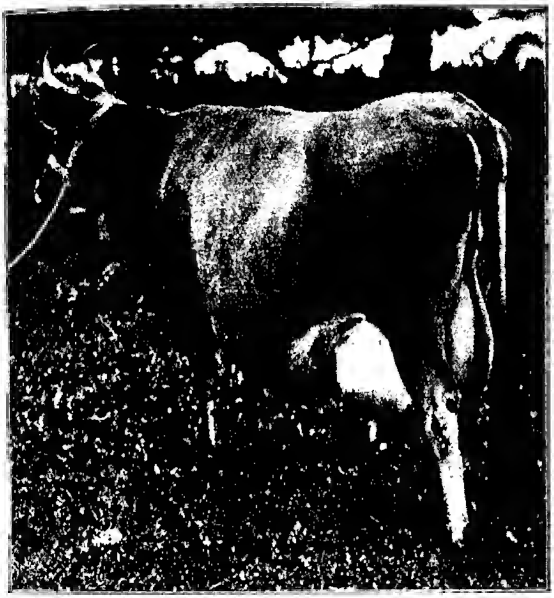
Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1917 ..	8 298	6·17	512·07 lbs.	250 lbs.	21½ lbs.	273

Champion Cow, Season 1916-17.

milk, yielding 542.5 lbs. of butter fat. This performance is highly creditable, for she entered the year under the disadvantage of a premature calving. Whilst she attains this position she does not, however, win the prize for the champion cow of the year, for the rule that prize-winners must calve again within fifteen months has not been complied with. She did not calve for twenty-one days over the allotted period. The position then of the champion for the year goes to the next cow on the list—a Jersey, "Mercede's Noble Queen," imported to New Zealand from Jersey, and purchased later in the Dominion by Mr. C. D. Lloyd, her present owner. Subject to her proving in calf, she gains the honour for the year with a standard of 8,298 lbs. of milk —6.17 per cent. test, giving 512 lbs. of butter fat. This cow was much

admired amongst others of Mr. Lloyd's team at the last Royal Show. Possessing, as she does, show quality, supported by a capability to give such a return, she is a particularly valuable animal, and will no doubt be heard of still further in the future. On her sire's side "Mercede's Noble Queen" is a half-sister of "Pretty Noble," which sired so many good heifers for Mr. Woodmason.

The next cow in the order of merit—"Peeress III."—is also one which appears for the first time under our test. This cow was purchased



Lady Gray V. Owner: Mr. A. W. Jones.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1914 ..	5,437¼	5·62	305·87 lbs.	175 lbs.	12 lbs.	259
1915 ..	8,323½	5.61	466·93 ,,	200 ,,	20 ,,	273
1916 ..	9,615	5·11	491·59 ,,	250 ,,	33 ,,	273
1917 ..	9,039¼	5·38	486·17 ,,	250 ,,	28¼ ,,	273

Reserve Champion Cow, Season 1916-17.

in South Australia, when in milk, by Mr. A. W. Jones, of St. Albans, and her record—488.5 lbs. of butter fat—is all the more meritorious as she had to undergo the discomfort of travelling and settling in her new home. She is of robust conformation, and will no doubt give a good account of herself in future years. Whilst she occupies this position on the list, she is not eligible to take the prize as reserve champion, for unfortunately she was not in calf early enough to comply with the regulations; the prize therefore goes to the same owner's cow

"Lady Grey V.," who thus secures this honour for the second year in succession. Her yield of 9,039.5 lbs. of milk, with 486 lbs. of butter fat, and 28½ lbs. of milk on the last day of the test, is not quite as good as last year, when she gave 491 lbs. of fat. This can largely be accounted for by the fact that she had great difficulty at calving time, and became affected with milk fever. The credit of her performance is enhanced by the fact that she has calved six times in seven years, and has had little respite from work. Her full record, as shown beneath her picture, shows her to be a consistent performer.

Mr. W. Woodmason's cow "Empire IV. of Melrose" is fifth in order of merit, with 8,745.5 lbs. of milk, 474 lbs. of fat, and 25.5 lbs. of milk after her run of 273 days. On her previous official lactation,

Muria. Owner: Department of Agriculture.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test
1914 ..	7,287	5·00	364·76 lbs.	250 lbs.	14½ lbs.	273
1915 ..	12,297½	5·74	705·88 ,,	250 ,,	30 ,,	273
1916 ..	9,993½	5·43	542·50 ,,	250 ,,	24 ,,	273

this cow was fourteenth in order of merit, with a yield of 8,534 lbs. of milk, 479 lbs. of fat, and 439 lbs. the year before, thus showing great consistency. Mr. Woodmason also occupies 10th and 11th position with "Quality VI. of Melrose," with 436.73 lbs. of fat, and "Jessie XI. of Melrose" with 436.17 lbs. to her credit. The former cow returned 478 lbs. last year, being fourth on the list, and 417 lbs. the previous calving, whilst the latter has to her credit yields of 430 lbs. in 1916; 420 lbs. in 1915. Last year's winner of the champion prize, "Jessie VI.," which calved within the allotted fifteen months, has not yet completed her term commenced this year.

Mr. C. D. Lloyd's old champion, in "Sweetbread XXIV.," still keeps in the forefront, and occupies sixth position with 464 lbs. of butter

fat. Her previous records were—452 lbs. in 1916, 482 lbs. in 1915, and 492 lbs. in 1914.

It is pleasing to observe that a new entrant for standard honours has been able to take such a position as is occupied by Mr. Thomas Mesley's Jersey "Bright Princess," which occupies seventh position amongst the aged cows with a record of 8,337 lbs. of milk and 457.7 lbs. of butter fat. There is no doubt we shall hear more of this breeder on future occasions.

The contention that satisfactory yields cannot be obtained, except on rich pastures, is discounted by the appearance amongst the leading 20 in a field of 145 aged cows of the names of "Arcadia," 441 lbs. of fat

Peeress III. Owner: Mr. A. W. Jones.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1917 ..	10,116	4·83	488·51 lbs.	250 lbs.	39 lbs.	273

and "Princess of Springhurst," 414 lbs. of fat. The first-named animal is the property of Mr. C. G. Knight, of Cobram, while the latter was entered by Mr. J. D. Read, of Springhurst.

Attention must again be drawn to Mr. C. G. Lyon's cow "Noreen," now 17 years old, which appears fourteenth in order of merit, with 427 lbs. of fat, following a yield of 473 lbs. last year, 471 the previous, and 523 lbs. in 1914.

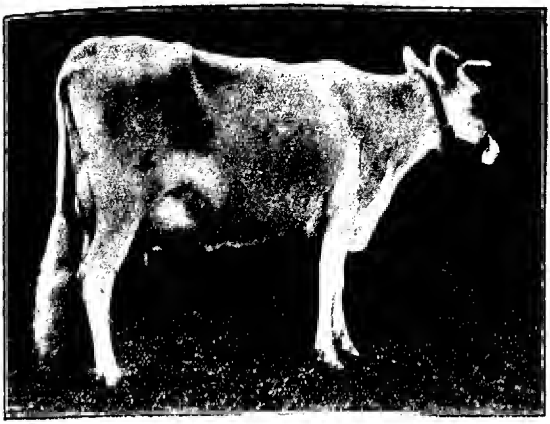
Of the second-calf cows under four years of age, the list is headed by Mr. Woodmason's "Lassie Fowler IV. of Melrose." By yielding 7,843 lbs. of milk and 425½ lbs. of fat, she has fulfilled her promise as a heifer when, being seventh in the class, she yielded 5,977 lbs. of

Empire IV. of Melrose. Owner: Mr. W. Woodmason.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1914 ..	7,787½	5·64	439·63 lbs.	250 lbs.	18¾ lbs.	273
1915 ..	8,534¼	5·61	479·13 "	250 "	26 "	273
1917 ..	8,745¾	5·43	474·68 "	250 "	25¾ "	273

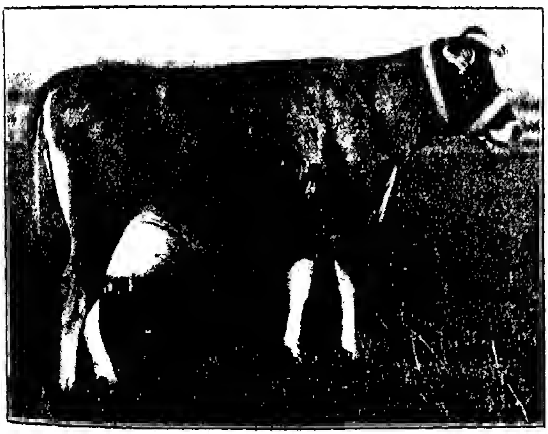
Golden Noble Duchess (imp.). Owner: Mr. C. D. Lloyd.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test
1917 ..	6,455	6·49	419·22 lbs.	250 lbs.	14½ lbs.	273



Bright Princess. Owner: Mr. T. Mesley.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1917 ..	8,337¼	5·49	457·70 lbs	250 lbs.	23¼ lbs.	273



Lassie Fowler IV. of Melrose. Owner: Mr. W. Woodmason.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1915 ..	5,977	5·69	340·32 lbs.	175 lbs.	15½ lbs.	273
1917 ..	7,843	5·43	425·54 „	200 ..	22 ,	273

milk and 340 lbs. of fat. Another of Mr. Woodmason's cows, "Graceful Duchess XI. of Melrose," by the same bull ("Pretty Noble"), occupies second place with 412 lbs. of fat. These attainments and the places occupied by other members of the herd give point to my remarks of last year regarding the transmission of milking qualities by "Pretty Noble."

Mr. Jones' cow "Lady Grey I.," which was first amongst the heifers last year, is maintaining her reputation, by appearing third in this class, with 5,970 lbs. of milk and 408.6 lbs. of fat, an improvement over last year, when her yield was 5,255 lbs. of milk and 347.3 lbs. of fat. Her average test this year is the highest recorded amongst all classes, being 6.85.

Mr. C. G. Lyon has a promising cow in "Molly IV. of Banyule." Her position of fifth on the list would indicate that the high standard of the "Banyule" herd will not suffer by her inclusion—her yield of

Ettie IV. Owner: Mr. C. Gordon Lyon.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1915 ..	8 743	4·56	398·86 lbs.	250 lbs.	25 lbs.	273
1916 ..	8,933¼	4·45	397·65 „	250 „	18 „	273

392 lbs. of butter fat, following 302 on her first calf, being highly creditable, and indicating that in her the qualities of her dam, which has a record up to 421 lbs. of fat in 1916, have not deteriorated.

Next in order of merit is "Lady Marge IV."—a member of Mr. Trevor Harvey's herd, which though of comparatively recent establishment, contains a large proportion of good producers.

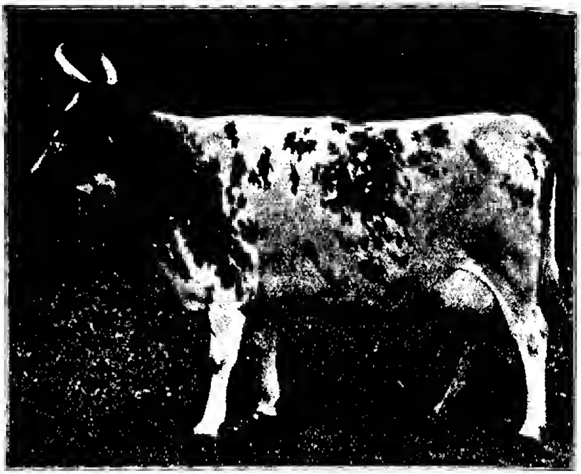
In the heifer class, Mr. Woodmason secures the first four positions with heifers sired by "Pretty Noble," giving a yield of 347, 343, 340, and 328.7 lbs. of fat respectively; while Mr. J. D. Read, with "Cobea" 328.3 lbs., and "Trefoil" 326 lbs., is not far behind with fifth and sixth places. With such young stock coming forward, there is not likely to be any recession from the highly satisfactory standard to which Mr. Read has raised his herd.

Cobæa of Springhurst. Owner: Mr. J. D. Read.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1917 ..	6,387	5·14	328·33 lbs.	175 lbs.	13¾ lbs.	273

Jenny Lind IX. of Melrose. Owner: Mr. W. Woodmason.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1917 ..	5,714½	6·07	347·06 lbs.	175 lbs.	13½ lbs.	273



Marjorie of Retreat. Owners: Messrs. Muhlebach Bros.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1916 ..	7,239½	4·63	335·07 lbs.	250 lbs.	8½ lbs.	273

Meadow Sweet II. Owner: Mr. T. Mesley.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1917 ..	6,643½	5·61	372·96 lbs.	250 lbs.	18 lbs.	273

Herd Prizes.

Six herds have qualified to compete for the Herd Prizes donated by the Government for the best herd of ten or more cows completing their period within the twelve months ended 30th June. These prizes are allotted on a handicap basis. In the first place, each heifer receives a handicap of 75 lbs. of butter fat. Each cow, on second calf, or three years of age when commencing, receives 50 lbs. In herds exceeding ten in number, each cow is allowed an amount of butter fat calculated at the rate of ½ lb. per cow of the herd. No herd in which the average of each cow is under 300 lbs. of fat, may compete.

Mr. A. W. Jones' "St. Albans" herd takes pride of place with the average of 424½ lbs. per cow. As this herd contains the minimum of ten cows, completing their test in the twelve months, the herd allowance does not apply, and is consequently not shown in the tabulated return.

Arum of Springhurst. Owner: Mr J. D. Read.

Year.		Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.	Days in test.
1916	..	4,529¼	5·34	240·26 lbs.	175 lbs.	10 lbs.	273
1917	..	5,614	5·66	317·60 ,,	200 ,,	7 ,,	273

Mr. Woodmason's "Melrose" herd is second with 395¼ lbs. of fat, including the herd allowance for its number of fifty-nine cows.

The average of the winning herd is outstanding, and no one is more persuaded than Mr. Jones that it is due to a virtue which can only be revealed by testing. A sufficiency of food was certainly provided (any dairyman is short-sighted who does not do so). Extravagance would have accomplished no more, and perhaps less. The difference between good and bad cows lies not in the capacity to consume food, but in their ability to obtain the maximum of nutriment therefrom and convert it into milk. There is nothing magical in the diet of oaten chaff, maize ensilage, bran and linseed meal, which was all these cows received in addition to their pasture.

Although the season has not been first-class from a dairying point of view, a comparison with last year's returns shows that the average

Three of Mr. *Gordon* Lyon's Jerseys.

PARRAKEET.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AUDREY LASSIE.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.
[illegible]	[illegible]	[illegible]	[illegible]	175	[illegible] lbs.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VELVETEEN.

Year.	Lbs. Milk.	Test.	Butter Fat.	Standard.	Milk last day.
[illegible]	[illegible]	[illegible]	[illegible]	250	[illegible] lbs.
[illegible]	[illegible]	[illegible]	[illegible]	250	[illegible]

production of most of the herds tends to rise. This is as it should be. An improved herd is the consummation of herd testing. No owner should be content to test his cows and leave it at that. If one does not act on the information which the scales and tester afford, he must soon fall back in competition with the man who does. Herd testing will disclose the unfit. It then rests with the owner to eliminate them. The standard constituting a first class herd is fast moving forward, and is now so far advanced as to be unattainable except by regular culling. The foremost herds are not in front because of herd testing alone, but because the owners are shrewd enough to utilize the information thus afforded. Herd testing is not an end in itself; it is the means to an end, which is the elimination of the unfit. Good feeding alone never yet made a first class milking herd. It is no doubt one, but only one, of the essentials. Let all the cows be fed equally well, uniformity of yield will not result. Certain cows will outstrip others by virtue of nothing else than inherent milking capacity. Feed will never make a good milker out of a born "duffer," and it is no use practical dairymen professing to believe that any one could put up records equal to the best herein published, by merely giving the same feed. It might deceive the novice, but never any man who has had even a short experience of herd testing. To excel, then, dairymen have no alternative but to test their cows. When the various capacities of the animals have thus been ascertained, culling should begin at the bottom. The remainder should be mated with only a pure bull from antecedents of known butter-producing capacity. In this way each generation is a step forward. "Known butter-producing capacity" does not mean merely an owner's assurance; he may know as little about it as the intending purchaser. An authentic guide to the merits of a bull's dam is the returns periodically published in this journal—that is, provided she has been entered for official testing. Failing this, it is only guess work, and dairymen are strongly advised to make use of the Government Standard Test instituted solely for their benefit. Each year's work is published annually in the September *Journal of Agriculture*, and the figures speak for themselves.

Standard Cow Prizes.

The following are the prizes offered by the Government for the year ended 30th June, 1917. The prizes will be awarded through the Royal Agricultural Society:—

(1) *Grand Champion Cow*—under Herd Test regulations.

A grand champion prize of £100 as a trophy or cash for maintaining the position of annual champion for three successive years. *Not yet allotted.*

(2) *Annual Champion Cow*—under Herd Test regulations.

A prize of £25, to be awarded to the cow which, on completion of lactation period, gives the greatest amount of butter fat under the herd testing regulations of this Department during a lactation period terminating within a year ending 30th June. If two lactation periods are completed within the year, the last will be the period considered.

Won by "Mercedes Noble Queen"; owner, Mr. C. D. Lloyd.

(3) *Annual Reserve Champion*—under Herd Test regulations.

A prize of £15 per annum to be awarded to the cow attaining second place under the herd testing regulations of the Department during year ended 30th June.

These prizes to be awarded conditionally upon the winning cow being exhibited at the next Royal Agricultural Show. In the event of the death of the winning cow prior to such show, the owner to exhibit his next best cow.

Won by "Lady Grey V."; owner, Mr. A. W. Jones.

(4) *Best Herd*—under Herd Testing regulations.

A 1st prize of £40 and a 2nd prize of £10 to be awarded to the herds giving the greatest average returns under the herd testing regulations of this Department, under the following conditions:—

(1) Minimum number of cows (completing the test during the year) in a herd—10.

(2) Such herd to average 300 lbs. of butter fat.

(*a*) Handicaps to be allowed under the following scale:—

I. A herd of more than 10 cows will receive a handicap of ½ lb. of butter fat for each cow.

II. Cows entered under Regulation 11 (*a*) will receive a handicap of 75 lbs. of butter fat.

III. Cows entered under Regulation 11 (*b*) and (*c*) to receive a handicap of 50 lbs. of butter fat.

The prize to be allotted for the year ending 30th June, and the three best cows in the winning herd to be exhibited at the next Royal Agricultural Society's Show.

First Prize won by St. Albans Herd; owner, Mr. A. W. Jones.

Second Prize won by Melrose Herd; owner Mr. W. Woodmason.

No cow competing for any prize shall be milked more than twice a day, and must calve again within fifteen months from prior calving.

The amounts offered as prizes will for the future be reduced. For animals completing the test during 1917-18 and onwards the prizes will be as under:—

Annual Champion	£10
Reserve Annual Champion	5
First Prize for best herd	20
Second Prize for best herd	10

RETURN OF CERTIFICATED COWS FOR YEAR ENDING 30th JUNE, 1917.

MRS. A. BLACK, Noorat. (Jersey.)

Completed during the year, 11. Certificated, 8.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Opaline	3578	26.4.16	3.5.16	273	11½	5,074	5·11	259·43	250	295¾
Grey Girl	2064	29.4.16	6.5.16	270	4½	4,796	5·48	263·06	250	300
Mona's Pearl ..	3577	1.5.16	8.5.16	273	9	5,469	5·07	277·62	250	316½
Flashlight	1972	5.5.16	12.5.16	270	4½	6,106	4·81	293·78	250	335
Marguerite	3576	10.5.16	17.5.16	266	4	6,282	4·47	281·01	250	320¼
Heatherbell	3574	26.6.16	3.7.16	220	4	5,607	4·92	276·12	250	314¾
Sheila V.	3580	27.6.16	4.7.16	224	4	4,241	5·05	214·51	200	244½
Dolly of Clydebank II.	3742	29.7.16	5.8.16	200	7	4,122	6·09	250·96	250	286

A. BOX, Hiawatha. (Jersey.)

Completed during the year, 5. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Roseneath Fox's Twylish	3775	8.11.15	15.11.15	273	4	5,735½	5·19	297·72	250	330¼
Laurie	3043	23.11.15	30.11.15	273	12½	5,313½	5·16	274·40	250	312¾

F. CURNICK, Malvern. (Jersey.)

Completed during the year, 2. Certificated 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter
					lbs.	lbs.		lbs.	lbs.	lbs.
Eva	3770	18.10.15	25.10.15	273	19	6,777	4·70	318·90	250	363½
Peerless Pearl ..	3771	1.2.16	8.2.16	273	16	5,364	5·07	271·90	250	310

DEPARTMENT OF AGRICULTURE, Werribee. (Red Poll.)

Completed during the year, 44. Certificated, 38.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Europa	Not yet allotted	29.9.15	6.10.15	273	11	7,425	4·46	331·20	250	377¼
Gallipoli	"	30.9.15	7.10.15	273	14½	6,771½	4·27	289·01	175	329½
La Belle France ..	"	30.9.15	7.10.15	273	19	6,119¾	4·50	275·28	175	313¾
Britannia	"	6.10.15	13.10.15	273	12½	6,887	4·10	282·26	250	321¾
Egypta	"	17.9.15	*17.10.15	273	15	6,887	4·03	277·41	250	316¼
Mahratta	"	20.10.15	27.10.15	273	12½	4,999½	4·89	244·69	175	279
Laurel	"	29.11.15	6.12.15	273	13	5,683½	3·66	208·15	200	237¼
Cutty	"	4.1.16	11.1.16	273	12	6,059	4·73	286·77	175	327
Muria	"	†14.1.16	21.1.16	273	24	9,993	5·43	542·50	250	618½
Aridia	"	2.2.16	9.2.16	273	8	4,210	4·89	205·81	175	234¾
Japana	"	11.2.16	18.2.16	273	23	7,997	3·42	273·39	250	311¾
Velveteen (imp.) ..	"	14.2.16	21.2.16	273	19	6,588	4·39	283·85	250	323½
Goldlace	"	28.2.16	6.3.16	273	25	6,642	4·51	299·29	175	341¼
Soudana	"	5.3.16	12.3.16	273	21	7,252	4·32	313·00	250	356¾
Canada	"	11.3.16	18.3.16	273	11	6,559	4·03	264·05	250	301
India	"	15.3.16	22.3.16	273	22	6,425	4·29	275·98	250	314½
Congo	"	20.3.16	27.3.16	273	16	7,142	4·19	299·66	250	341¼
Barbary	"	23.3.16	30.3.16	250	5	6,541	3·99	261·17	200	297¾
Panama	"	31.3.16	7.4.16	273	26	8,658	4·33	374·61	250	427
Carribea	"	10.4.16	17.4.16	273	14	7,414	4·18	310·10	250	353½
Avesia	"	15.4.16	22.4.16	273	19	6,315	4·43	280·08	175	319¼
Australiana	"	20.6.16	27.6.16	273	14	4,582½	4·63	212·28	200	242
Phillipina	"	24.6.16	1.7.16	273	14½	7,069	4·68	330·61	250	377
Vuelta	"	30.6.16	7.7.16	273	4	7,914	4·18	330·42	250	376¾
Alpina	"	6.7.16	13.7.16	273	12½	7,292	3·84	280·14	250	319¼
Mexicana	"	7.7.16	14.7.16	273	6	8,549	3·98	341·09	250	388¾
Tonga	"	18.7.16	25.7.16	273	18	6,452	4·53	292·74	175	333¾
Sylvia	"	18.7.16	25.7.16	261	3	6,180½	4·80	296·97	250	338
Tasmania	"	21.7.16	28.7.16	273	16	6,508	4·11	270·06	250	307¾
Sumatra	"	21.7.16	28.7.16	273	25	9,579½	4·46	427·25	250	487
Goldleaf	"	22.7.16	29.7.16	273	13	6,558½	4·19	274·98	250	313½
Ontario	"	24.7.16	31.7.16	273	26	8,157½	3·96	323·48	250	368¾
Europa	"	26.7.16	2.8.16	273	18½	6,772½	4·40	298·29	250	339¾
Tennessee	"	27.7.16	3.8.16	273	22	8,497½	4·16	354·65	250	404¼
Primrose League (imp.)	"	20.8.16	27.8.16	273	16	7,214	4·00	288·80	250	329¼
Egypta	"	15.8.16	22.8.16	273	18	6,676½	3·90	260·97	250	296
La Reina	"	16.8.16	23.8.16	273	12	6,469½	4·77	308·74	250	352
Cuba	"	14.9.16	21.9.16	‡253	17½	7,508	4·17	313·28	250	357¼

* Entry deferred owing to attack of mammitis. —† Calved two months prematurely.
‡ Sold 20 days before completion of term.

C. FALKENBERG, Elliminyt. (Jersey.)

Completed during the year, 8. Certificated, 8.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Fancy of Colac ..	Not yet allotted	22.10.15	29.10.15	273	10	4,932	4·57	225·41	200	257
Duchess of Colac ..	"	24.3.16	31.3.16	273	13	4,443	5·05	224·33	200	255¾
Annie of Taringa ..	"	16.6.16	23.6.16	273	13	5,689	5·86	333·32	250	380
Silver Queen of Taringa	"	23.6.16	30.6.16	273	6	5,207	5·02	261·62	250	298¾
Handsome Lassie of Colac	"	31.7.16	7.8.16	273	10	4,824½	5·08	245·34	175	279¾
Silver Belle of Colac ..	"	9.8.16	16.8.16	273	16	4,133¾	5·20	215·13	175	245¼
Fancy of Colac ..	"	27.8.16	3.9.16	273	12	6,189½	4·77	295·07	250	336½
Doris II. of Kingsvale	"	20.9.16	27.9.16	273	16	5,694	5·72	325·77	250	371¼

GEELONG HARBOUR TRUST. (Ayrshire.)

Completed during the year, 13. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Gipsy Maid II. of Sparrovale ..	2511	17.5.16	24.5.16	273	12	5,859	4·35	255·00	250	290¾
Gaiety of Gowrie Park	2875	17.5.16	24.5.16	273	14½	6,849½	4·65	315·42	250	359¼
Maid of Sparrovale ..	Not yet allotted	23.6.16	30.6.16	273	19¾	7,299½	4·08	297·80	175	339½
Ruby of Glen Elgin ..	1836	2.7.16	9.7.16	273	7	6,073	4·22	256·34	250	292¼
Clover of Sparrovale ..	2872	3.7.16	10.7.16	273	11½	5,593½	4·51	252·18	175	287½

W. C. GREAVES, Monomeith. (Ayrshire.)

Completed during the year, 4. Certificated 4.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Letty of Warrook ..	Not yet allotted	12.6.16	*12.7.16	237	20	5,343	5·21	278·47	175	317½
Fuchsia of Warrook ..	2544	2.8.16	†17.8.16	273	22	7,849	4·46	350·24	250	399¼
Frolic	1855	2.8.16	†17.8.16	273	16	7,108	4·33	307·71	250	350¾
Fidget of Warrook ..	2541	25.8.16	1.9.16	269	7½	7,427	4·43	328·66	250	371¾

* Entry deferred the month permitted by the Regulations, but, nevertheless, the first 36 days lost owing to yields not being recorded.

† Entry deferred until weighing was commenced.

TREVOR HARVEY, Boisdale. (Jersey.)

Completed during the year, 5. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Dainty VI.	Not yet allotted	10.3.16	17.3.16	273	7½	5,985	5·57	333·25	200	380
Sparkle	2978	15.5.16	22.5.16	273	18	6,483	5·85	379·36	250	432¼
Kirsty V.	Not yet allotted	22.6.16	29.6.16	273	14½	5,237¼	6·01	314·73	175	358¾
Lady Marge IV. ..	..	30.8.16	6.9.16	273	14	6,342	5·99	379·82	200	433
Bluebell of Pine Hills	2975	4.9.16	11.9.16	273	7	6,759	5·88	397·45	250	453

EDWARD HAYES, Archie's Creek. (Jersey.)

Completed during the year, 4. Certificated, 4.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Gazelle	Not yet allotted	27.7.16	3.8.16	273	19	7,550	4·82	364·32	250	415¼
Namesake II. ..	"	2.8.16	9.8.16	273	16½	7,226	5·13	370·68	250	422½
Verbena of Luscombe	"	10.9.16	17.9.16	273	10	4,436	5·54	246·17	175	280½
Garenne II.	"	19.9.16	26.9.16	273	10	4,698	6·02	282.90	175	322½

A. W. JONES, St. Albans, Geelong. (Jersey.)

Completed during the year, 10. Certificated, 10.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Silver Queen II. of Colac	4032	27.8.15	*24.9.15	273	13½	4,888½	6·33	309·33	200	352¾
Dolly	3754	3.12.15	10.12.15	273	19	6 838	6·63	453·38	250	516¾
Lady Grey I. of St. Albans	4186	20.3.16	27.3.16	273	18½	5,970	6·85	408·67	200	466
Lady Grey VIII. ..	4187	25.3.16	1.4.16	273	21	8,667	4·99	432·26	250	492¾
Buttercup	875	25.6.16	2.7.16	273	26½	8,927	4·25	379·26	250	432¼
Lady Grey V. ..	3756	11.7.16	18.7.16	273	28½	9,039½	5·38	†486·17	250	554¼
Blanchette I. of St. Albans	Not yet allotted	23.7.16	30.7.16	273	14	5,313½	5·36	284·99	175	325
Peeress III.	"	26.7.16	2.8.16	273	39	10,116	4·83	488·51	250	557
Jubilee XV.	"	28.8.16	‡25.9.16	252	21½	7,694	5·60	431·10	250	491½
Belle of Colac ..	4024	15.9.16	22.9.16	273	20	7,824	4·42	346·16	200	304½

* Entry deferred one month owing to early yields not being recorded.
† Attack milk fever and difficult parturition affected yield.
‡ Lost the first 21 days through weights not being available.

C. D. LLOYD, Caulfield. (Jersey.)

Completed during the year, 7. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Countess Twylish ..	928	22.10.15	29.10.15	273	16	7,140	5·02	358·48	250	409¾
Golden Noble Duchess (imp.)	Not yet allotted	7.8.16	14.8.16	273	14½	6,455	6·49	419·22	250	478
Sweetbread XXIV. (imp.)	2979	18.8.16	25.8.16	273	11	8,608	5·39	464·20	250	529
Creambread	Not yet allotted	25.8.16	1.9.16	273	13	5,700	6·17	351·57	200	400¾
Mercedes Noble Queen (imp.) ..	"	14.9.16	21.9.16	273	21½	8,298	6·17	512·07	250	583¾

C. G. KNIGHT, Cobram. (Jersey.)

Completed during the year, 20. Certificated, 20.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Royal Rose	2585	29.9.15	6.10.15	273	14½	6,518½	5·83	379·78	250	433
Christmas	Not yet allotted	18.10.15	25.10.15	273	11½	3,521½	5·42	190·86	175	217½
Princess of Tarnpirr ..	2986	29.10.15	5.11.15	273	6½	5,744	4·67	268·49	250	306
Idyll's Morocco ..	Not yet allotted	18.11.15	25.11.15	273	16	4,025½	4·87	196·04	175	223½
Mistletoe of Tarnpirr	2984	6.1.16	13.1.16	273	27	6,937	4·85	336·32	250	383½
My Queen of Tarnpirr..	Not yet allotted	5.4.16	12.4.16	273	16½	4,707½	5·67	267·08	175	304½
Doreen of Tarnpirr ..	2982	17.5.16	24.5.16	273	16	5,643	5·44	307·11	200	350
Sweetbread of Tarnpirr	Not yet allotted	31.5.16	7.6.16	273	11½	5,240½	4·99	261·29	175	297¾
Romany Lass ..	2563	8.6.16	15.6.16	273	13½	6,038½	5·32	321·15	250	366
Alice of Tarnpirr ..	Not yet allotted	21.7.16	28.7.16	273	9½	5,443	5·71	310·96	250	354½
Mythic	2404	28.7.16	4.8.16	273	15½	7,240	5·29	382·72	250	436¼
Rosebud of Tarnpirr ..	Not yet allotted	3.8.16	10.8.16	273	10	4,615	5·98	276·00	175	314¾
Arcadia	1534	7.8.16	14.8.16	273	10½	8,407	5·25	441·39	250	503¼
Foxglove of Tarnpirr	2983	17.8.16	24.8.16	273	9½	5,081	6·20	315·44	250	359½
Idyll's Ideal ..	2096	20.8.16	27.8.16	273	9	7,021	4·83	339·52	250	387
Peep Bo	Not yet allotted	24.8.16	31.8.16	273	12½	5,175	5·30	274·56	175	313
Primrose of Tarnpirr ..	2985	28.8.16	4.9.16	273	11½	5,482	5·54	304·09	250	346
Idyll	2095	12.9.16	19.9.16	273	4½	5,419	4·61	251·48	250	287
Bonny	2980	14.9.16	21.9.16	273	11½	5,652	5·96	337·27	250	384
Lily of Tarnpirr ..	2221	15.9.16	22.9.16	273	11½	6,468	4·63	299·68	250	341¾

C. G. LYON, Heidelberg. (Jersey.)

Completed during the year, 16. Certificated, 16.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Silvermine IV. ..	716	4.11.15	11.11.15	269	18	7,415	4·92	364·77	250	415¾
Ettie IV.	2889	26.12.15	2.1.16	273	18	8,933½	4·45	397·65	250	453¼
Lassie II.	1136	26.12.15	2.1.16	273	17½	8,055½	4·91	395·30	250	450¾
Lassie	500	7.1.16	14.1.16	273	17	7,347	4·67	343·29	250	391¼
Hawthorn of Banyule	1064	1.4.16	8.4.16	273	12	5,717	4·89	279·56	250	318¾
Silver Audrey ..	1378	16.4.16	23.4.16	273	14	5,909	5·31	313·78	250	357¾
Hawthorn II. of Banyule ..	3619	3.5.16	10.5.16	273	8½	5,281	4·99	263·78	250	300¾
Milkmaid 37th ..	1222	23.5.16	30.5.16	273	18	7,598½	5·14	390·59	250	445¼
Velveteen II. ..	2927	28.5.16	4.6.16	273	16	7,400	4·62	341·68	250	389½
Zoe V.	1497	15.7.16	22.7.16	273	14	6,680	5·56	372·09	250	424¼
Melodious	2336	5.8.16	12.8.16	273	10	7,161	5·26	377·04	250	429¾
Majesty's Starbright ..	1185	10.8.16	17.8.16	273	18	6,835	5·57	380·82	250	434¼
Parrakeet	3625	7.9.16	14.9.16	273	15	7,823	4·31	337·03	250	384¼
Noreen	636	8.9.16	15.9.16	273	17	8,951	4·78	427·94	250	487¾
Molly IV. of Banyule ..	Not yet allotted	22.9.16	29.9.16	273	13½	7,491	5·24	392·85	200	447¾
Silvermine XIII. of Banyule	"	25.9.16	1.10.16	273	15	5,636	5·41	305·18	175	348

T. MESLEY, Dalyston. (Jersey.)

Completed during the year, 5. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Bright Princess ..	Not yet allotted	12.7.16	*24.7.16	273	23½	8,337½	5·49	457·70	250	521¾
Meadow Sweet II. ..	"	29.7.16	*8.8.16	273	18	6,643½	5·61	372·96	250	425¼
Fairy Belle	"	10.8.16	17.8.16	273	10	4,769	6·15	293·37	175	334½
Little Queen ..	"	11.8.16	18.8.16	273	15¼	6,282½	5·71	358·80	200	409
Philomel	"	20.7.16	*20.8.16	273	19¼	6,406	5·31	340·44	250	388

* Entry deferred till weights first available.

J. D. READ, Springhurst. (Jersey.)

Completed during the year, 29. Certificated, 29.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Stockings of Springhurst ..	2663	18.3.16	25.3.16	273	12¼	6,363	5·03	320·15	250	365
Euron of Springhurst ..	1918	26.3.16	2.4.16	273	14¼	6,476	5·77	373·78	250	426
Lupin of Springhurst ..	Not yet allotted	29.3.16	5.4.16	*239	16	5,003½	5·28	264·61	200	301¾
Princess of Springhurst	2521	15.4.16	22.4.16	273	9¼	7,324	5·66	414·27	250	472¼
Princess Defiance of Springhurst	Not yet allotted	17.4.16	24.4.16	273	7	5,742	5·61	322·10	200	367¼
Graceful Magnet of Springhurst ..	2058	27.4.16	4.5.16	273	4½	6,569½	5·08	339·91	250	380¼
Grannie of Springhurst	2059	2.5.16	9.5.16	273	6	5,351	6·03	323·01	250	368¼
Aisyke of Springhurst	1515	20.5.16	27.5.16	273	16	6,654	4·81	319·89	250	364¾
Daisy of Springhurst ..	1788	22.5.16	29.5.16	250	3½	4,994½	5·39	269·29	250	307
Trefoil of Springhurst ..	Not yet allotted	24.5.16	31.5.16	273	9½	5,898½	5·54	326·52	175	372¼
Buttercup of Springhurst	3702	2.6.16	9.6.16	273	7½	6,285½	5·87	368·98	250	420¼
Solanum of Springhurst	Not yet allotted	8.6.16	15.6.16	273	8	5,509	4·95	272·81	175	311
Coben of Springhurst	"	13.6.16	20.6.16	273	13½	6,387	5·14	328·33	175	374¼
Hyacinth of Springhurst	3705	16.6.16	23.6.16	273	8	4,786	5·77	276·05	250	314¾
Tulip of Springhurst ..	2730	18.6.16	25.6.16	273	6	5,965	5·30	316·06	250	360¼
Czarina of Springhurst	Not yet allotted	21.6.16	28.6.16	273	11½	5,411	5·34	289·15	175	329¾
Boronia of Springhurst	"	24.6.16	1.7.16	264	4	5,035	5·21	263·89	200	300¾
Iris of Springhurst ..	3706	25.6.16	2.7.16	273	8½	5,687	5·42	308·36	250	351½
Musk of Springhurst ..	Not yet allotted	5.7.16	12.7.16	273	7	4,415	5·47	241·53	200	275¼
Dulcie of Springhurst ..	1878	8.7.16	15.7.16	251	4	5,484	5·55	304·20	250	346¾
Lobelia of Springhurst	Not yet allotted	10.7.16	17.7.16	273	6	4,498	5·55	249·64	175	284½
Balsam of Springhurst	"	19.7.16	26.7.16	273	9	5,233	5.63	294·48	200	335¾
Arum of Springhurst ..	"	21.7.16	28.7.16	273	7	5,614	5.66	317·60	200	362
Foxglove of Springhurst	3704	21.7.16	28.7.16	247	4¼	5,193	4·95	257·07	250	293
Calla of Springhurst ..	Not yet allotted	28.7.16	4.8.16	273	12	5,597	4·86	272·05	175	310¼
Primrose of Springhurst	"	31.7.16	7.8.16	273	9	5,022	5·10	256·14	175	292
Freesia of Springhurst	"	31.7.16	7.8.16	273	9	4,716	5·60	264·26	175	301¼
Daffodil of Springhurst	"	9.8.16	16.8.16	273	7½	4,258	5·91	251·80	175	287
Rose of Springhurst ..	"	21.8.16	28.8.16	273	9	3,973	5·42	215·25	175	245½

* Sold 34 days before completion of term.

MUHLEBACH BROS., Batesford. (Ayrshire.)

Completed during the year, 7. Certificated, 6.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard Required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Gracious of Glenarthur	2324	28.9.15	*8.10.15	265	4	6,313½	4·11	259·39	250	295¾
Marjorie of Retreat ..	2963	13.10.15	20.10.15	273	8¼	7 239½	4·63	335·07	250	382
Camellia of Retreat ..	2605	26.4.16	3.5.16	273	11¼	6 686	4·20	280·84	200	320¼
Marjorene of Retreat	2962	5.7.16	12.7.16	273	12½	5,918	4·33	256·11	175	292
Fuchsia of Retreat ..	2960	28.8.16	4.9.16	273	10	4,590	4·40	201·75	175	230
Daphne of Retreat ..	2959	21.9.16	28.9.16	273	8½	4,648	4·35	202·16	175	230½

* Entry deferred three days till weights first recorded.

MISS S. L. ROBINSON, Malvern. (Jersey.)

Completed during the year, 7. Certificated, 3.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Twinkle	538 C.S H B.	14 2.16	21.2.16	273	29	7,247	4·65	336·96	250	384¼
Lady Grey VI ..	421 C S H.B	22.7.16	29.7.16	273	14	4,865	5·19	252·19	175	287½
Lassie	3699 A.J H.B.	7.8.16	14.8.16	273	11	4,865½	5·26	261·00	250	297½

GEO. ROWE, Kardella. (Jersey.)

Completed during the year, 2. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Daffodil	157 C.S.H.B.	24.7.16	31.7.16	273	11½	5,503	4·66	256·29	250	292¼

D. SADLER, Camperdown. (Ayrshire.)

Completed during the year, 7. Certificated, 5.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Get of Kilmarnock ..	3092	12.10.15	19.10.15	*268	21	7,088	4·05	287·00	250	327½
Lady Loch of Kilmarnock	3095	14.10.15	21.10.15	243	4½	4,881½	4·28	209·01	200	238½
Pearl of Kilmarnock ..	3098	13.7.16	20.7.16	212	4	5,704	4·39	250·40	250	285¼
Brilliant of Kilmarnock	3090	23.7.16	30.7.16	262	3½	5,649	4·72	266·39	250	303¾
Kathleen of Kilmarnock	3093	11.8.16	18.8.16	273	7½	5,722½	4·71	269·79	250	307½

* Yields not recorded after 12th July.

W. WOODMASON, Malvern. (Jersey.)

Completed during the year, 59. Certificated, 58.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Daisy VI. of Melrose ..	Not yet allotted	3.10.15	10.10.15	273	9	5,459½	5·10	279·99	200	319½
Chevy VII. of Melrose	3636	12.10.15	19.10.15	273	12	4,725¼	5·77	272·84	250	311
Lassie Fowler V. of Melrose ..	Not yet allotted	19.10.15	26.10.15	273	12	3,764½	5·62	211·64	175	241¼
Peerless IX. of Melrose	,,	19.10.15	26.10.15	273	11½	4,544½	5·25	238·56	175	272
Pearl II. of Melrose ..	3670	25.10.15	1.11.15	273	12½	5,770½	5·45	314·45	250	358½
Vanilla VII. of Melrose	Not yet allotted	26.10.15	2.11.15	273	14	5,315	5·90	313·89	175	357¾
Jessie V. of Melrose ..	3652	30.10.15	6.11.15	273	19	7,452½	5·25	391·51	250	446¼
Flower VI. of Melrose	3641	2.11.15	9.11.15	273	21	7,100½	5·50	390·72	250	445½
Peerless VI. of Melrose	3671	6.11.15	13.11.15	273	11	6,199½	5·65	350·54	250	399½
Handsome Girl VIII. of Melrose	Not yet allotted	8.11.15	15.11.15	273	15	4,971	6·13	304·81	175	352
Rarity VII. of Melrose	,,	8.11.15	15.11.15	273	14	5,181	4·91	254·49	175	290
Chevy VIII. of Melrose	,,	10.11.15	17.11.15	273	20½	5,686½	6·05	344·08	200	392¼
Quality VI. of Melrose	3674	11.11.15	18.11.15	273	24	8,327	5·24	436·73	250	497¾
Blossom III. of Melrose	3633	19.11.15	26.11.15	273	16	6,631	4·18	277·22	250	316
Edith II. of Melrose ..	Not yet allotted	27.11.15	4.12.15	273	18½	6,630½	4·73	313·79	200	357¾
Mystery XII. of Melrose	3667	27.11.15	4.12.15	273	16	6,628	5·15	341·40	250	389¼
Rarity VI. of Melrose..	3675	29.11.15	6.12.15	273	18½	8,070½	4·92	396·77	250	452¼
Daisy V. of Melrose ..	3637	12.12.15	19.12.15	273	17½	6,558	5·30	347·81	250	396½
Pleasance V. of Melrose	Not yet allotted	21.12.15	28.12.15	273	17½	4,505	5·25	236·53	200	269¾
Fuchsia X. of Melrose..	,,	24.12.15	31.12.15	273	21	7,553½	4·26	321·56	200	366½
Peerless III. of Melrose	2817	28.12.15	4.1.16	273	15	7,341	5·26	386·15	250	440¼
Mystery XIII. of Melrose	3668	31.12.15	7.1.16	273	18½	6,148	6·48	398·23	250	454
Pleasance IV of Melrose	1297	9.1.16	16.1.16	273	20	6,352	4·17	265·08	250	302¼
Jessie IX. of Melrose ..	3654	1.3.16	8.3.16	273	20½	6,961	5·32	370·18	250	422
Blossom IV. of Melrose	Not yet allotted	8.3.16	15.3.16	273	16	5,678	5·79	328·73	175	374¾
Mermaid II. of Melrose	,,	11.3.16	18.3.16	273	19	6,607	4·74	313·50	250	357½
Mystery IX. of Melrose	3665	23.3.16	30.3.16	273	11	5,080	5·85	297·08	250	338¾
Purity IV. of Melrose..	1324	23.4.16	30.4.16	273	11	4,698	5·69	267·39	250	304¾
Lassie Fowler IV. of Melrose	Not yet allotted	26.4.16	3.5.16	273	22	7,843	5·43	425·54	200	485
Mystery VIII. of Melrose	3664	6.5.16	13.5.16	273	19½	6,434	6·10	392·49	250	447½
Empire IV. of Melrose..	3639	7.5.16	14.5.16	273	25½	8,745½	5·43	474·68	250	541¼
Laura VI. of Melrose ..	3658	17.5.16	24.5.16	273	17½	7,746½	5·39	417·61	250	476
Pearl III. of Melrose ..	Not yet allotted	7.6.16	14.6.16	273	6½	4,927½	6·44	317·18	200	361½

W. WOODMASON, Malvern—*continued.*

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Mayflower VI. of Melrose	Not yet allotted	14.6.16	21.6.16	273	11½	4,570½	6·63	303·22	175	345¾
Vanilla	"	30.6.16	7.7.16	273	12¼	4,617½	5·46	251·98	175	287¼
Lady Melrose IV. ..	"	1.7.16	8.7.16	273	10½	7,047	4·71	331·99	250	378½
Jenny Lind VIII. of Melrose	3651	5.7.16	12.7.16	273	8½	5,836½	5·56	324·47	250	370
Jenny Lind IX. of Melrose	Not yet allotted	5.7.16	12.7.16	273	13½	5,714½	6·07	347·06	175	395¾
Laura IX. of Melrose ..	"	7.7.16	14.7.16	273	14	5,394	6·37	343·39	175	391½
Lassie Fowler III. of Melrose	1137	10.7.16	17.7.16	273	12	7,034½	5·14	361·95	250	412¼
Jessie XIV. of Melrose	Not yet allotted	10.7.16	17.7.16	273	14	5,692	5·98	340·20	175	387¾
Jessie XII. of Melrose..	"	12.7.16	19.7.16	273	13	6,296	5·95	374·92	200	427½
Jessie XV. of Melrose..	"	13.7.16	20.7.16	273	10½	4,113	6·57	270·26	175	308
Gaiety Girl IX. of Melrose	"	13.7.16	20.7.16	273	10	4,260½	6·42	273·50	175	311¾
Vanilla VI. of Melrose	"	20.7.16	27.7.16	273	12	7,386	4·91	362·93	250	413¾
Jessie XIII. of Melrose	"	20.7.16	27.7.16	273	13½	6,290	6·38	401·75	200	458
Graceful Duchess XI. of Melrose.. ..	"	11.8.16	18.8.16	273	17½	6,798	6·07	412·49	200	470¼
Polly II. of Melrose ..	"	21.8.16	28.8.16	273	19½	7,585	5·30	401·81	250	457
Vanilla V. of Melrose ..	3678	28.8.16	4.9.16	260	4	7,707	5·02	387·11	250	441½
Pearl of Melrose ..	3669	28.8.16	4.9.16	273	17½	7,913	4·75	376·43	250	429¼
Peerless VII. of Melrose	3672	8.9.16	15.9.16	273	11½	5,549	5·76	319·71	250	364
Daphne VII. of Melrose	Not yet allotted	10.9.16	17.9.16	273	13	5,071	6·21	315·19	175	359½
Jessie XI. of Melrose ..	3656	10.9.16	17.9.16	273	18	6,986	6·24	436·17	250	497¼
Sweet Pansy III. of Melrose	Not yet allotted	11.9.16	18.9.16	273	4½	4,523	6·23	282·02	175	321½
Daisy VII. of Melrose..	"	12.9.16	19.9.16	273	15	5,706	5·53	315·53	175	359¾
Carrie V. of Melrose ..	3634	12.9.16	19.9.16	273	16½	6,710	6·20	415·86	250	474
Sweet Pansy of Melrose	1413	18.9.16	25.9.16	266	4	5,096	6·23	317·62	250	362
Peerless VIII. of Melrose	3673	19.9.16	26.9.16	273	12½	7,287	5·30	386·36	250	440½

COWS IN ORDER OF MERIT.

Cows over 4 years of Age or on third lactation period—250 lbs. Standard.

Order of Merit.	Name of Cow.	Herd Book No.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Butter.
					lbs.		lbs.	lbs.
1	Muria	Not yet allotted	Department of Agriculture	Red Poll	9,993½	5·43	542·50	618½
2	Mercedes Noble Queen (imp.)	"	C. D. Lloyd ..	Jersey ..	8,298	6·17	512·07	583¾
3	Peeress III.	"	A. W. Jones ..	" ..	10,116	4·83	488·51	557
4	Lady Grey V.	3756	A. W. Jones ..	" ..	9,039½	5·38	486·17	554¼
5	Empire IV. of Melrose ..	3639	W. Woodmason ..	" ..	8,745½	5·43	474·68	541¼
6	Sweetbread XXIV. (imp.)..	2979	C. D. Lloyd ..	" ..	8,608	5·39	464·20	529
7	Bright Princess	Not yet allotted	T. Mesley ..	" ..	8,337½	5·49	457·70	521¾
8	Dolly	3754	A. W. Jones ..	" ..	6,838	6·63	453·38	516¾
9	Arcadia	1534	C. G. Knight ..	" ..	8,407	5·25	441·39	503¼
10	Quality VI. of Melrose ..	3674	W. Woodmason ..	" ..	8,327	5·24	436·73	497¾
11	Jessie XI. of Melrose ..	3656	W. Woodmason ..	" ..	6,986	6·24	436·17	497¼
12	Lady Grey VIII... ..	4187	A. W. Jones ..	" ..	8,667	4·99	432·26	492¾
13	Jubilee XV.	Not yet allotted	A. W. Jones ..	" ..	7,694	5·60	431·10	491½
14	Noreen	636	C. G. Lyon ..	" ..	8,954	4·78	427·94	487¾
15	Sumatra	Not yet allotted	Department of Agriculture	Red Poll	9,579½	4·46	427·25	487
16	Golden Noble Duchess (imp.)	"	C. D. Lloyd ..	Jersey ..	6,455	6·49	419·22	478
17	Laura VI. of Melrose ..	3658	W. Woodmason ..	" ..	7,746½	5·39	417·61	476
18	Carrie V. of Melrose ..	3634	W. Woodmason ..	" ..	6,710	6·20	415·86	474
19	Princess of Springhurst ..	2521	J. D. Read ..	" ..	7,324	5·66	414·27	472½

Cows over 4 Years of Age or on Third Lactation Period—250 lbs. Standard—*continued.*

Order of Merit.	Name of Cow.	Herd Book No.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Butter.
					lbs.		lbs.	lbs.
20	Polly II. of Melrose ..	Not yet allotted	W. Woodmason ..	Jersey ..	7,585	5·30	401·81	457
21	Mystery XIII. of Melrose ..	3668	W. Woodmason ..	" ..	6,148	6·48	398·23	454
22	Ettie IV.	2889	C. G. Lyon ..	" ..	8,933½	4·45	397·65	453¼
23	Bluebell of Pine Hills ..	2975	T. Harvey ..	" ..	6,759	5·88	397·45	453
24	Rarity VI. of Melrose ..	3675	W. Woodmason ..	" ..	8,070½	4·92	396·77	452¼
25	Lassie II.	1136	C. G. Lyon ..	" ..	8,055½	4·91	395·30	450¾
26	Mystery VIII. of Melrose ..	3664	W. Woodmason ..	" ..	6,434	6·10	392·49	447½
27	Jessie V. of Melrose ..	3652	W. Woodmason ..	" ..	7,452½	5·25	391·51	446¼
28	Flower VI. of Melrose ..	3641	W. Woodmason ..	" ..	7,109½	5·50	390·72	445½
29	Milkmaid 37th	1222	C. G. Lyon ..	" ..	7,598½	5·14	390·59	445¼
30	Vanilla V. of Melrose ..	3678	W. Woodmason ..	" ..	7,707	5·02	387·11	441¼
31	Peerless VIII. of Melrose ..	3673	W. Woodmason ..	" ..	7,287	5·30	386·30	440¼
32	Peerless III. of Melrose ..	2817	W. Woodmason ..	" ..	7,341	5·26	386·15	440¼
33	Mythic	2104	C. G. Knight ..	" ..	7,240	5·29	382·72	436¼
34	Majesty's Starbright ..	1185	C. G. Lyon ..	" ..	6,835	5·57	380·82	434¼
35	Royal Rose	2585	C. G. Knight ..	" ..	6,518½	5·83	379·78	433
36	Sparkle	2978	T. Harvey ..	" ..	6,483	5·85	379·30	432¼
37	Buttercup	875	A. W. Jones ..	" ..	8,927	4·25	379·26	432¼
38	Melodious	2336	C. G. Lyon ..	" ..	7,161	5·26	377·04	429¾
39	Pearl of Melrose	3669	W. Woodmason ..	" ..	7,913	4·75	376·43	429¼
40	Panama	Not yet allotted	Department of Agriculture	Red Poll	8,658	4·33	374·61	427
41	Euroa of Springhurst ..	1918	J. D. Read ..	Jersey ..	6,476	5·77	373·78	426
42	Meadow Sweet II. ..	Not yet allotted	T. Mesley ..	" ..	6,643½	5·61	372·96	425¼
43	Zoe V.	1497	C. G. Lyon ..	" ..	6,680	5·56	372·09	424¼
44	Namesake II.	Not yet allotted	E. Hayes ..	" ..	7,226	5·13	370·68	422½
45	Jessie IX. of Melrose ..	3654	W. Woodmason ..	" ..	6,961	5·32	370·18	422
46	Buttercup of Springhurst ..	3702	J. D. Read ..	" ..	6,285½	5·87	368·98	420¾
47	Silvermine IV.	716	C. G. Lyon ..	" ..	7,415	4·92	364·77	415¾
48	Gazelle	Not yet allotted	E. Hayes ..	" ..	7,550	4·82	364·32	415¼
49	Vanilla VI. of Melrose ..	"	W. Woodmason ..	" ..	7,386	4·91	362·93	413¾
50	Lassie Fowler III. of Melrose	1137	W. Woodmason ..	" ..	7,034½	5·14	361·95	412¾
51	Countess Twylish ..	928	C. D. Lloyd ..	" ..	7,140	5·02	358·48	409¾
52	Tennessee	Not yet allotted	Department of Agriculture	Red Poll	8,497½	4·16	354·65	404¼
53	Peerless VI. of Melrose ..	3671	W. Woodmason ..	Jersey ..	6,199½	5·65	350·54	399¼
54	Fuchsia of Warrook ..	2544	W. C. Greaves ..	Ayrshire ..	7,849	4·46	350·24	399¼
55	Daisy V. of Melrose ..	3637	W. Woodmason ..	Jersey ..	6,558	5·30	347·81	396¼
56	Lassie	509	C. G. Lyon ..	" ..	7,347	4·67	343·29	391¼
57	Velveteen II.	2927	C. G. Lyon ..	" ..	7,400	4·62	341·68	389½
58	Mystery XII. of Melrose ..	3667	W. Woodmason ..	" ..	6,628	5·15	341·40	389¼
59	Mexicana	Not yet allotted	Department of Agriculture	Red Poll	8,549	3·98	341·09	388¾
60	Philomel	"	T. Mesley ..	Jersey ..	6,406	5·31	340·44	388
61	Graceful Magnet of Springhurst	2058	J. D. Read ..	" ..	6,569½	5·08	339·91	380¾
62	Idyll's Ideal	2096	C. G. Knight ..	" ..	7,021	4·83	339·52	387
63	Bonnie	2980	C. G. Knight ..	" ..	5,652	5·96	337·27	384
64	Parrakeet	3625	C. G. Lyon ..	" ..	7,823	4·31	337·03	384¼
65	Twinkle..	538 C.S.J.H.B.	Miss S. L. Robinson	" ..	7,247	4·65	336·96	384¼
66	Mistletoe of Tarnpirr ..	2984	C. G. Knight ..	" ..	6,937	4·85	336·32	383½
67	Marjorie of Retreat ..	2963	Muhlebach Bros. ..	Ayrshire ..	7,239½	4·63	335·07	382
68	Annie of Taringa ..	Not yet allotted	C. Falkenberg ..	Jersey ..	5,689	5·86	333·32	380
69	Lady Melrose IV. ..	"	W. Woodmason ..	Jersey ..	7,047	4·71	331·99	378½
70	Europa	"	Department of Agriculture	Red Poll	7,425	4·46	331·20	377½
71	Phillipina	"	Department of Agriculture	" ..	7,069	4·68	330·61	377
72	Vuelta	"	Department of Agriculture	" ..	7,914	4·18	330·42	376¾
73	Fidget of Warrook ..	2541	W. C. Greaves ..	Ayrshire ..	7,427	4·43	328·66	374¾
74	Doris II. of Kingsvale ..	Not yet allotted	C. Falkenberg ..	Jersey ..	5,694	5·72	325·77	371½
75	Jenny Lind VIII. of Melrose	3651	W. Woodmason ..	" ..	5,836½	5·56	324·47	370
76	Ontario	Not yet allotted	Department of Agriculture	Red Poll	8,157½	3·96	323·18	368¾
77	Grannie of Springhurst ..	2059	J. D. Read ..	Jersey ..	5,351	6·03	323·01	368¼
78	Romany Lass	2563	C. G. Knight ..	" ..	6,038½	5·32	321·15	366

COWS OVER 4 YEARS OF AGE OR ON THIRD LACTATION PERIOD—250 LBS. STANDARD—*continued.*

Order of Merit.	Name of Cow.	Herd Book No.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Butter.
					lbs.		lbs.	lbs.
79	Stockings of Springhurst ..	2663	J. D. Read ..	Jersey ..	6,363	5·03	320·15	365
80	Alsyke of Springhurst ..	1515	J. D. Read ..	,, ..	6,654	4·81	319·89	364¾
81	Peerless VII. of Melrose ..	3672	W. Woodmason ..	,, ..	5,549	5·76	319·71	364
82	Eva	3770	F. Curnick ..	,, ..	6,777	4·70	318·90	363¼
83	Sweet Pansy of Melrose ..	1413	W. Woodmason ..	,, ..	5,096	6·23	317·62	362
84	Tulip of Springhurst ..	2730	J. D. Read ..	,, ..	5,965	5·30	316·06	360¼
85	Foxglove of Tarnpirr ..	2983	C. G. Knight ..	,, ..	5,081	6·20	315·44	359¼
86	Gaiety of Gowrie Park ..	2875	Geelong Harbour Trust	Ayrshire ..	6,849½	4·65	315·42	359½
87	Pearl II. of Melrose ..	3670	W. Woodmason ..	Jersey ..	5,770½	5·45	314·45	358¼
88	Silver Andrey	1378	C. G. Lyon ..	,, ..	5,909	5·31	313·78	357¾
89	Mermaid II. of Melrose ..	Not yet allotted	W. Woodmason ..	,,	6,607	4·74	313·50	357½
90	Cuba	,,	Department of Agriculture	Red Poll	7,508	4·17	313·28	357¼
91	Sondana	,,	Department of Agriculture	,, ..	7,252	4·32	313·00	356¾
92	Alice of Tarnpirr.. ..	,,	C. G. Knight ..	Jersey ..	5,443	5·71	310·96	354¼
93	Carribea	,,	Department of Agriculture	Red Poll	7,414	4·18	310·10	353½
94	La Reina	,,	Department of Agriculture	,, ..	6,469½	4·77	308·74	352
95	Iris of Springhurst ..	3706	J. D. Read ..	Jersey ..	5,687	5·42	308·36	351½
96	Frolic	1855	W. C. Greaves ..	Ayrshire ..	7,108	4·33	307·71	350¾
97	Dulcie of Springhurst ..	1878	J. D. Read ..	Jersey ..	5,484	5·55	304·20	346¾
98	Primrose of Tarnpirr ..	2085	C. G. Knight ..	,, ..	5,482	5·54	304·09	346
99	Lily of Tarnpirr	2221	C. G. Knight ..	,, ..	6,468	4·63	299·68	341¾
100	Congo	Not yet allotted	Department of Agriculture	Red Poll	7,142	4·19	299·66	341½
101	Europa	,,	Department of Agriculture	,, ..	6,772½	4·40	298·29	339¾
102	Roseneath Fox's Twylish ..	3775	A. Box	Jersey ..	5,735½	5·19	297·72	339½
103	Mystery IX. of Melrose ..	3665	W. Woodmason ..	,, ..	5,080	5·85	297·08	338¾
104	Sylvia	Not yet allotted	Department of Agriculture	Red Poll	6,180½	4·80	296·97	338
105	Fancy of Colac	,,	C. Falkenberg ..	Jersey ..	6,189½	4·77	295·07	336½
106	Flashlight	1972	Mrs. A. Black ..	,, ..	6,106	4·81	293·78	335
107	Primrose League (imp.) ..	Not yet allotted	Department of Agriculture	Red Poll	7,214	4·00	288·80	329¼
108	Get of Kilmarnock ..	3092	D. Sadler ..	Ayrshire ..	7,088	4·05	287·00	327½
109	Velveteen (imp.)	Not yet allotted	Department of Agriculture	Red Poll	6,588	4·30	283·85	323½
110	Britannia	,,	Department of Agriculture	,, ..	6,887	4·10	282·26	321¾
111	Marguerite	3576	Mrs. A. Black ..	Jersey ..	6,282	4·47	281·01	320½
112	Alpina	Not yet allotted	Department of Agriculture	Red Poll	7,292	3·84	280·14	319½
113	Hawthorn of Banyule ..	1064	C. G. Lyon ..	Jersey ..	5,717	4·89	279·56	318¾
114	Mona's Pearl	3577	Mrs. A. Black ..	,, ..	5,460	5·07	277·62	316½
115	Egypta	Not yet allotted	Department of Agriculture	Red Poll	6,887	4·03	277·41	316¼
116	Blossom III. of Melrose ..	3633	W. Woodmason ..	Jersey ..	6,631	4·18	277·22	316
117	Heatherbell	3574	Mrs. A. Black ..	,, ..	5,607	4·92	276·12	314¾
118	Hyacinth of Springhurst ..	3705	J. D. Read ..	,, ..	4,786	5·77	276·03	314½
119	India	Not yet allotted	Department of Agriculture	Red Poll	6,425	4·29	275·98	314½
120	Goldleaf	,,	Department of Agriculture	,, ..	6,558½	4·19	274·98	313½
121	Laurie	3043	A. Box	Jersey ..	5,313½	5·16	274·40	312¾
122	Japana	Not yet allotted	Department of Agriculture	Red Poll	7,997	3·42	273·39	311¾
123	Cherry VII. of Melrose ..	3636	W. Woodmason ..	Jersey ..	4,725½	5·77	272·84	311
124	Peerless Pearl	3771	F. Curnick ..	,, ..	5,364	5·07	271·90	310
125	Tasmania	Not yet allotted	Department of Agriculture	Red Poll	6,508	4·14	270·06	307¾
126	Kathleen of Kilmarnock ..	3093	D. Sadler ..	Ayrshire ..	5,722½	4·71	269·79	307½
127	Daisy of Springhurst ..	1788	J. D. Read ..	Jersey ..	4,094½	6·58	269·29	307
128	Princess of Tarnpirr ..	2986	C. G. Knight ..	,, ..	5,744	4·67	268·49	306
129	Purity IV. of Melrose ..	1324	W. Woodmason ..	,, ..	4,698	5·69	267·39	304¾
130	Brilliant of Kilmarnock ..	3090	D. Sadler ..	Ayrshire ..	5,649	4·72	266·39	304¼
131	Pleasance IV. of Melrose ..	1297	W. Woodmason ..	Jersey ..	6,352	4·17	265·08	302¼
132	Canada	Not yet allotted	Department of Agriculture	Red Poll	6,559	4·03	264·05	301
133	Hawthorn II. of Banyule ..	3619	C. G. Lyon ..	Jersey ..	5,281	4·99	263·78	300¾
134	Grey Girl	2064	Mrs. A. Black ..	,, ..	4,796	5·48	263·06	300

Cows over 4 Years of Age or on Third Lactation Period—250 lbs. Standard—*continued.*

Order of Merit.	Name of Cow.	Herd Book No.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Butter.
					lbs.		lbs.	lbs.
135	Silver Queen of Taringa ..	Not yet allotted	C. Falkenberg ..	Jersey ..	5,207	5·02	261·62	298¼
136	Lassie	3699	Miss S. L. Robinson	,, ..	4,865½	5·36	261·00	297½
137	Egypta	Not yet allotted	Department of Agriculture	Red Poll	6,676¼	3·90	260·97	296
138	Opaline	3578	Mrs. A. Black ..	Jersey ..	5,074	5·11	259·43	295½
139	Gracious of Glenarthur ..	2324	Muhlebach Bros. ..	Ayrshire ..	6,313½	4·11	259·39	295¾
140	Foxglove of Springhurst ..	3704	J. D. Read ..	Jersey ..	5,193	4·95	257·07	293
141	Ruby of Glen Elgin ..	1836	Geelong Harbour Trust	Ayrshire ..	6,673	4·22	256·34	292¼
142	Daffodil	157 C.S.J.H.B.	G. Rowe ..	Jersey ..	5,503	4·66	256·29	292¼
143	Gipsy Maid II. of Sparrowvale	2511	Geelong Harbor Trust	Ayrshire ..	5,859	4·35	255·00	290¾
144	Idyll	2095	C. G. Knight ..	,, ..	5,449	4·61	251·48	287
145	Dolly of Clydebank II. ..	3742	Mrs. A. Black ..	,, ..	4,122	6·09	250·96	286
146	Pearl of Kilmarnock ..	3098	D. Sadler ..	Ayrshire ..	5,704	4·39	250·40	285½

Cows under 4 Years of Age—200 lbs. Standard.

Order of Merit.	Name of Cow.	Herd Book No.	Owner.	Breed.	Milk.	Average Test.	Butter Fat.	Butter.
					lbs.		lbs.	lbs.
1	Lassie Fowler IV. of Melrose	Not yet allotted	W. Woodmason ..	Jersey ..	7,843	5·43	425·54	485
2	Graceful Duchess XI. of Melrose	,,	W. Woodmason ..	,, ..	6,798	6·07	412·49	470¼
3	Lady Grey I. of St. Albans	4186	A. W. Jones ..	,, ..	5,970	6·85	408·67	466
4	Jessie XIII. of Melrose ..	Not yet allotted	W. Woodmason ..	,, ..	6,299	6·38	401·75	458
5	Molly IV.	,,	C. G. Lyon ..	,, ..	7,491	5·24	392·85	447¾
6	Lady Marge IV.	,,	T. Harvey ..	,, ..	6,342	5·99	379·82	433
7	Jessie XII. of Melrose ..	,,	W. Woodmason ..	,, ..	6,296	5·95	374·92	427¼
8	Little Queen	,,	T. Mesley ..	,, ..	6,282½	5·71	358·80	409
9	Creambread	,,	C. B. Lloyd ..	,, ..	5,700	6·17	351·57	400¾
10	Belle of Colac	4024	A. W. Jones ..	,, ..	7,824	4·42	346·16	394¼
11	Chevy VIII. of Melrose ..	Not yet allotted	W. Woodmason ..	,, ..	5,686½	6·05	344·08	392¼
12	Dainty VI.	,,	T. Harvey ..	,, ..	5,985	5·57	333·25	380
13	Princess Defiance of Springhurst	,,	J. D. Read ..	,, ..	5,742	5·61	322·10	367¼
14	Fuchsia X. of Melrose ..	,,	W. Woodmason ..	,, ..	7,553½	4·26	321·56	366½
15	Arum of Springhurst ..	,,	J. D. Read ..	,, ..	5,614	5·66	317·60	362
16	Pearl III. of Melrose ..	,,	W. Woodmason ..	,, ..	4,927½	6·44	317·18	361¼
17	Edith II. of Melrose ..	,,	W. Woodmason ..	,, ..	6,630½	4·73	313·79	357¾
18	Silver Queen II. of Colac ..	4032	A. W. Jones ..	,, ..	4,888½	6·33	309·33	352¾
19	Doreen of Tarnpirr ..	2982	C. G. Knight ..	,, ..	5,643	5·44	307·11	350
20	Balsam of Springhurst ..	Not yet allotted	J. D. Read ..	,, ..	5,233	5·63	294·48	335¾
21	Camellia of Relreat ..	2605	Muhlebach Bros. ..	Ayrshire ..	6,686	4·20	280·81	320¼
22	Daisy VI. of Melrose ..	Not yet allotted	W. Woodmason ..	Jersey ..	5,459½	5·10	279·99	319¼
23	Lupin of Springhurst ..	,,	J. D. Read ..	,, ..	5,003½	5·28	264·61	301¾
24	Boronia of Springhurst ..	,,	J. D. Read ..	,, ..	5,035	5·24	263·89	300¾
25	Barbary	,,	Department of Agriculture	Red Poll	6,541	3·99	261·17	297¾
26	Musk of Springhurst ..	Not yet allotted	J. D. Read ..	Jersey ..	4,415	5·47	241·53	275¼
27	Pleasance V. of Melrose ..	,,	W. Woodmason ..	,, ..	4,505	5·25	236·53	269¾
28	Fancy of Colac	,,	C. Falkenberg ..	,, ..	4,932	4·57	225·41	257
29	Duchess of Colac	,,	C. Falkenberg ..	,, ..	4,443	5·05	224·33	255¾
30	Shiela V.	3580	Mrs. A. Black ..	,, ..	4,241	5·05	214·54	244½
31	Australiana	,,	Department of Agriculture	Red Poll	4,582½	4·63	212·28	242
32	Lady Loch of Kilmarnock ..	3095	D. Sadler ..	Ayrshire ..	4,881½	4·28	209·01	238¼
33	Laurel	Not yet allotted	Department of Agriculture	Red Poll	5,683½	3·66	208·15	237¼

Heifers—175 lbs. Standard.

Order of Merit.	Name of Cow.	Herd Book No.	Owner.	Breed.	Milk.	Average Test.	Butter Fat	Butter.
					lbs.	*	lbs.	lbs.
1	Jenny Lind IX. of Melrose	Not yet allotted	W. Woodmason ..	Jersey ..	5,714½	6·07	347·06	395¾
2	Laura IX. of Melrose ..	"	W. Woodmason ..	" ..	5,394	6·37	343·39	391½
3	Jessie XIV. of Melrose ..	"	W. Woodmason ..	" ..	5,692	5·98	340·20	387¾
4	Blossom IV. of Melrose ..	"	W. Woodmason ..	" ..	5,678	5·79	328·73	374¾
5	Cobea of Springhurst ..	"	J. D. Read ..	" ..	6,387	5·14	328·33	374¼
6	Trefoil of Springhurst ..	"	J. D. Read ..	" ..	5,898½	5·54	326·52	372¼
7	Daisy VII. of Melrose ..	"	W. Woodmason ..	" ..	5,706	5·53	315·53	359¾
8	Daphne VII. of Melrose ..	"	W. Woodmason ..	" ..	5,071	6·21	315·19	359¼
9	Kirsty V.	"	T. Harvey ..	" ..	5,237½	6·01	314·73	358¾
10	Vanilla VII. of Melrose ..	"	W. Woodmason ..	" ..	5,315	5·90	313·89	357¾
11	Silvermine XIII. of Banyule	"	C. G. Lyon ..	" ..	5,636	5·41	305·18	348
12	Handsome Girl VIII. of Melrose	"	W. Woodmason ..	" ..	4,971	6·13	304·81	352
13	Mayflower VI. of Melrose ..	"	W. Woodmason ..	" ..	4,570½	6·63	303·22	345¾
14	Goldlace	"	Department of Agriculture	Red Poll	6,642	4·51	299·29	341¼
15	Maid of Sparrovale ..	"	Geelong Harbour Trust	Ayrshire	7,299½	4·08	297·80	339½
16	Fairy Belle	"	T. Mesley ..	Jersey	4,769	6·15	293·37	334½
17	Tonga	"	Department of Agriculture	Red Poll	6,452	4·53	292·74	333¾
18	Czarina of Springhurst ..	"	J. D. Read ..	Jersey ..	5,411	5·34	289·15	329½
19	Gallipoli	"	Department of Agriculture	Red Poll	6,771½	4·27	289·01	329½
20	Cutty	"	Department of Agriculture	Red Poll	6,059	4·73	286·77	327
21	Blanchette I. of St. Albans	"	A. W. Jones ..	Jersey ..	5,313½	5·36	284·99	325
22	Garenne II.	"	E. Hayes ..	" ..	4,698	6·02	282·90	322½
23	Sweet Pansy III. of Melrose	"	W. Woodmason ..	" ..	4,523	6·23	282·02	321½
24	Avesia	"	Department of Agriculture	Red Poll	6,315	4·43	280·08	319¼
25	Letty of Warrook ..	"	W. C. Greaves ..	Ayrshire ..	5,343	5·21	278·47	317½
26	Rosebud of Tarnpirr ..	"	C. G. Knight ..	Jersey ..	4,615	5·98	276·00	314½
27	La Belle France	"	Department of Agriculture	Red Poll	6,119½	4·50	275·28	313¾
28	Peep Bo	"	C. G. Knight ..	Jersey ..	5,175	5·30	274·50	313
29	Gaiety Girl IX. of Melrose	"	W. Woodmason ..	" ..	4,260½	6·12	273·50	311¾
30	Solanum of Springhurst ..	"	J. D. Read ..	" ..	5,509	4·95	272·81	311
31	Calla of Springhurst ..	"	J. D. Read ..	" ..	5,597	4·86	272·05	310¼
32	Jessie XV. of Melrose ..	"	W. Woodmason ..	" ..	4,113	6·57	270·26	308
33	My Queen of Tarnpirr ..	"	C. G. Knight ..	" ..	4,707½	5·67	267·06	304½
34	Freesia of Springhurst ..	"	J. D. Read ..	" ..	4,716	5·60	264·26	301¼
35	Sweetbread of Tarnpirr ..	"	C. G. Knight ..	" ..	5,240½	4·99	261·29	297¾
36	Primrose of Springhurst ..	"	J. D. Read ..	" ..	5,022	5·10	256·14	292
37	Marjorene of Retreat ..	2962	Muhlebach Bros. ..	Ayrshire ..	5,918	4·33	256·11	292
38	Rarity VII. of Melrose ..	Not yet allotted	W. Woodmason ..	Jersey ..	5,181	4·91	254·49	290
39	Lady Grey VI.	421 C.S.J.H.B.	Miss S. L. Robinson	" ..	4,863	5·19	252·19	287½
40	Clover of Sparrovale ..	2872	Geelong Harbour Trust	Ayrshire	5,593½	4·51	252·18	287½
41	Vanilla VIII. of Melrose ..	Not yet allotted	W. Woodmason ..	Jersey ..	4,017½	5·46	251·98	287¼
42	Daffodil of Springhurst ..	"	J. D. Read ..	" ..	4,258	5·91	251·80	287
43	Lobelia of Springhurst ..	"	J. D. Read ..	" ..	4,498	5·55	249·64	284½
44	Verbena of Luscombe ..	"	E. Hayes ..	" ..	4,436	5·54	246·17	280½
45	Handsome Lassie of Colac	"	C. Falkenberg ..	" ..	4,824½	5·08	245·34	279½
46	Mahratta	"	Department of Agriculture	Red Poll	4,999½	4·89	244·69	279
47	Peerless IX. of Melrose ..	"	W. Woodmason ..	Jersey ..	4,544½	5·25	238·56	272
48	Rose of Springhurst ..	"	J. D. Read ..	" ..	3,973	5·42	215·25	245½
49	Silver Bell of Colac ..	"	C. Falkenberg ..	" ..	4,133½	5·20	215·13	245¼
50	Lassie Fowler V. of Melrose		W. Woodmason ..	" ..	3,761½	5·62	211·64	241¼
51	Aridia		Department of Agriculture	Red Poll	4,210	4·89	205·81	234½
52	Daphne of Retreat ..	2959	Muhlebach Bros. ..	Ayrshire ..	4,648	4·35	202·16	230½
53	Fuchsia of Retreat ..	2960	Muhlebach Bros. ..	" ..	4,590	4·40	201·75	230
54	Idyll's Morocco	Not yet allotted	C. G. Knight ..	Jersey ..	4,025½	4·87	196·04	223½
55	Christmas	"	C. G. Knight ..	" ..	3,521½	5·42	190·86	217½

HERD AVERAGES.

A. W. JONES' "St. Alban's" Herd.

Cows of Herd in their Respective Classes.		Butter Fat.	Average.
		lbs.	
6 Mature Cows yielded		2,670·68	445·11
3 Second-calf Cows yielded	1,064·16 lbs.	..	354·72
Handicap of 50 lbs. each	150·00 lbs.		
		1,214·16	
1 Heifer yielded	284·99 lbs.	..	284·99
Handicap of 75 lbs.	75·00 lbs.	359·99	
Herd total, including all due handicap allowances		4,244·83	424·48

W. WOODMASON'S "Melrose" Herd.

Cows of Herd in their Respective Classes.		Butter Fat.	Average
		lbs.	
33 Mature Cows yielded		11,758·31	356·31
10 Second-calf Cows yielded	3,427·83 lbs.	..	342·78
Handicap of 50 lbs. each	500·00 lbs.		
		3,927·83	
16 Heifers yielded	4,694·47 lbs.	..	293·40
Handicap of 75 lbs. each	1,200·00 lbs.		
		5,894·47	
Return (without herd allowance)		21,580·61	365·77
59 Cows in herd allowed 29½ lbs. each (equal to ½ lb. per cow)		1,740·50	
Herd Total (including all due handicap allowances)		23,321·11	395·27

C. G. LYON'S "Banyule" Herd.

Cows of Herd in their Respective Classes.		Butter Fat.	Average.
		lbs.	
14 Mature Cows yielded		4,985·32	356·09
1 Second-calf Cow yielded	392·85 lbs.	..	392·85
Handicap of 50 lbs.	50·000 lbs.		
		442·85	
1 Heifer yielded	305·18	..	305·18
Handicap of 75 lbs.	75·00 lbs.		
		380·18	
Return (without herd allowance)		5,808·35	363·02
16 Cows in herd allowed 8 lbs. each (equal to ½ lb. per Cow)..		128·00	
Herd total (including all due handicap allowances)		5,936·35	371·02

J. D. READ'S "Springhurst" Herd.

Cows of Herd in their Respective Classes.		Butter Fat.	Average.
		lbs.	
13 Mature Cows yielded		4,191·00	322·38
Second-calf Cows yielded	1,704·21 lbs.	..	284·03
Handicap of 50 lbs. each	300·00 lbs.		
		2,004·21	
10 Heifers yielded	2,735·95 lbs.	..	272·59
Handicap of 75 lbs. each	750·00 lbs.		
		3,475·95	
Return (without herd allowance)		9,671·16	333·49
29 Cows in herd allowed 14½ lbs. each (equal to ½ lb. per Cow) . ..		120·50	
Herd total (including all due handicap allowances)		10,091·66	347·99

C. G. KNIGHT'S "Tarnpirr" Herd.

Cows of Herd in their Respective Classes.		Butter Fat.	Average.
		lbs.	
13 Mature Cows yielded		4,288·28	329·87
1 Second-calf Cow yielded	307·11 lbs.	..	307·11
Handicap of 50 lbs.	50·00 lbs.		
		357·11	
6 Heifers yielded	1,465·81 lbs.	..	244·30
Handicap of 75 lbs. each	450·00 lbs.		
		1,915·81	
Return (without herd allowance)		6,561·20	328·06
20 Cows in herd allowed 10 lbs. each (equal to ½ lb. per Cow)		200·00	
Herd total (including all due handicap allowances)		6,761·20	338·06

AGRICULTURAL DEPARTMENT'S Research Farm Herd.

Cows of Herd in their Respective Classes.		Butter Fat.	Average.
		lbs.	
31 Mature Cows yielded		9,362·70	302·02
5 Second-calf Cows yielded	967·97 lbs.	..	193·59
Handicap of 50 lbs. each	250·00 lbs.		
		1,217·97	
8 Heifers yielded	2,173·67 lbs.	..	271·71
Handicap of 75 lbs. each	600·00 lbs.		
		2,773·67	
Return (without herd allowance)		13,354·34	303·51
44 Cows allowed 22 lbs. each (equal to ½ lb. per Cow)		968·00	
Herd total (including all due handicap allowances)		14,322·34	325·51

APPLE CULTURE IN VICTORIA.

By J. Farrell, Orchard Supervisor.

(Continued from page 469.)

SETTING AND DEVELOPMENT OF THE FRUIT.

During seasons when normal weather conditions prevail, while the trees are in blossom, the full-bloom stage of a variety lasts from two to three days. This stage may be shorter or it may extend over a longer period when the weather is dry, hot, and windy, or when it is calm, with occasional light showers and moderate temperatures respectively.

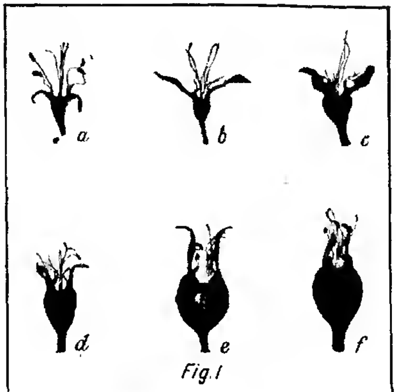
When the petals have fallen, denoting that the period of pollination has passed, the orchardist patiently awaits the signs of fruit-setting as the results of successful fertilization. If success attends the action of the pollen tubes coming into contact with the ovules, the young fruit soon commences to swell when the petals drop off. The flower stalks particularly and the other parts of the florets, which fail to set fruit, quickly turn yellow, indicating that they have lost their vitality; these soon become detached and fall off.

Plate 123, Fig. 1, depicts six stages of the young fruit of the Duchess de Oldenburg variety, and shows the condition of the fruit at the end of each period of three days from the time the petals fall. It will be understood that (*a*) is the most critical stage, as the petals have just fallen, but the fruit has not yet commenced to swell. Specimen (*b*) shows the condition of the little fruit three days later. Owing to the swelling of the fleshy part particularly, the sepals have commenced to alter their positions by gradually inclining to the horizontal and later to the vertical. In stages (*c*), (*d*), (*e*), which are six, nine, and twelve days respectively from the fall of the petals, it will be observed that the process of fruit development has so far advanced that it only needs the sixth stage (*f*), fifteen days from the falling of the petals, to show, as almost invariably happens, that the sepals forming the calyx completely enclose the withered stamens and pistil at the end of this period. There are a few instances of varieties such as the Rymer in the case of which the calyx often remains partly open until the fruit is matured.

Considerably higher percentage of blooms, when they arrive at stage (*a*), wither and fall than at any other time. Nevertheless, after the fruit has commenced to swell as shown in the various other stages, and even when it is quarter grown, when self thinning out commences, large numbers often lose their vitality and fall to the ground. This has the effect in many instances of reducing what at first appears a good crop to a light one. In some varieties, such as Jonathan, Reinette de Canada, London Pippin, &c., this habit of thinning out is more noticeable than it is in Yates, Morgan's Seedling, Rome Beauty, and others. Excessive thinning out, however, may be reduced to a minimum, even in varieties most subject to it, by keeping the trees free from Black Spot during the previous year, by feeding them well, systematic pruning, careful attention to drainage, and by good soil management.

Fig. 2 is a vertical section of that very fine quality, double purpose, and profitable apple, the Stewart's, formerly known as Stewart's

Seedling. The tree is a thrifty, good doer, whose rather large fruit ripens late and keeps well. Stewart's is most eminently suitable for cool storage, as it retains its good quality, and when taken out for market at the end of the season, is usually as sound and fresh as when placed in the stores.



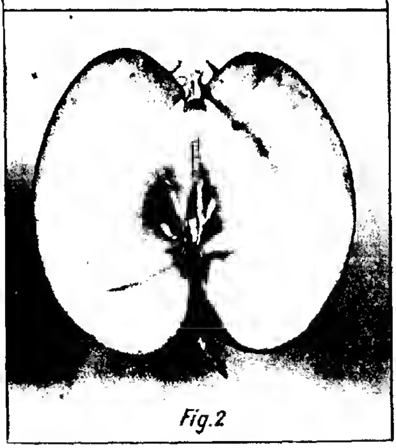


Plate 123.—**Fig. 1 shows six stages of development of the young apple after the petals have fallen.**

Fig. 2.—Vertical section of a Stewart's apple showing formation of the calyx.

The purpose of the illustration, however, is to show the formation and condition of the calyx when the fruit is fully matured. It will be observed that a portion of the withered pistil and stamens still remain, and that they are protected by the sepals as in the first stage of the flower.

As the fruit advances through the various stages from the time of fertilization until it arrives at maturity it should be kept free from Black Spot by the judicious use of fungicides. If the fruit be allowed to become a host for this disease, which spoils its shape, injures its colour, and impairs its quality, a product with reduced commercial value is the result. Under these adverse conditions high-class specimens for show purposes are often difficult to procure.

Bordeaux mixture if improperly made, or, if it be not diluted to a strength consistent with the requirements of the variety under treatment, frequently causes russetting of the rind of delicate sorts like the Jonathan. If the principal details connected with spraying are not scientifically accomplished, in the case of fruit for show particularly, the spray mixture often renders the fruit almost as unsuitable for this purpose as would the disease.

As it is known that the lime sulphur wash, when applied at a strength suitable to the needs of delicate-skinned varieties, does not russet them like Bordeaux mixture, it has of recent years been mostly used in preference to the latter. The spray mixture also keeps the foliage free from this parasite, which, if allowed to take possession, soon sends its mycelium through the leaf tissues and destroys them. When the functional powers of the leaves, viz., breathing in gaseous food, sap elaboration, and the giving out of waste, become seriously impaired, the fruit produced is of inferior quality.

Ripening of the Fruit.

When an apple has commenced to ripen as a result of the chemical changes which take place in the various elements which constitute its component parts, the pips begin to change in colour from yellowish white to brown, and later, when the stage of maturity is reached, they become almost black.

Before being used as a food, and in the interests of health it is desirable that apples for dessert purposes should have attained the ripe stage prior to being distributed for human consumption; whereas culinary sorts, on having arrived at a certain stage of development, become palatable and healthy food when cooked. In most cases, however, the choicer dishes are obtained after the apples have been allowed to ripen. Nevertheless, it is often advisable, when the trees are carrying a heavy crop, to thin out and dispose of the larger fruits for culinary use.

As young trees usually produce large apples, and as high prices are mostly obtainable for early cookers, it often proves a good commercial proposition to pick the fruit when large enough for market: this also facilitates the trees' development.

Apples, as regards their ripening, may be considered as belonging to two classes. One class ripens better and assumes a more agreeable flavour and better quality when picked from the tree on commencing to mature, while in the case of the other, better results are obtained when the fruit is allowed to ripen on the trees. The London Pippin may be regarded as a good representative of the former, while the King David is the best exponent of the latter class.

District Fruit Shows.

The orchardists in the various fruit-growing centres take a live interest in their local fruit shows. These are held annually under the

auspices of the different district horticultural societies. Friendly rivalry or, rather, keen competition is the dominant factor that invariably characterizes the fruit-growers' interest in the many fruit sections and classes. Apples, as a rule, constitute the leading feature of these shows. During seasons when the conditions congenial to the growth of this fruit are favorable to its development, particularly through the ripening period, typical and high-class specimens are almost invariably staged.

Besides being of interest as a means of local and inter-district competitions and as a source of profit to the established fruit-growers, these shows afford educational facilities of high value to the less experienced orchardists and to a rapidly increasing number of other students of horticulture, and particularly in relation to pomological nomenclature and variety identification. By this means, also, persons interested in apple-growing are afforded an opportunity of studying the effects of the many classes of soil and climatic conditions on the fruit of the apple varieties in the different districts, and under the methods of management practised locally. These methods, it may be further stated, chiefly embrace cultivation, manuring, irrigation, drainage, pruning, spraying, and the time of fruit-picking (local climate and soil adaptability having been considered).

As to times of picking fruit it should be mentioned that during recent years there has been a tendency on the part of apple-growers to pick certain dessert varieties for market too early. This remark has special reference to the Jonathan, as many instances of the undesirably early picking of this variety for local and Inter-State, as well as for oversea markets, have come under the notice of the writer.

This practice is to be deprecated, for notwithstanding the fact that on certain soils which are suitable to its cultivation, the fruit of the Jonathan may become large, and perhaps prematurely assume a high colour, yet, when picked before it has advanced to a certain stage of development wilting of the rind and general deterioration usually set in, rather than that the desirable condition of ripeness is reached.

When selecting fruit specimens for show competition those endowed with the recognised typical variety characteristics and of symmetrical formation and colour particularly, should be chosen. They should be free from blemish caused by hail, black spot, spray mixtures, or codlin moth. In the case of dessert varieties the specimens may be of medium size, although dissatisfaction is often caused through the want of a recognised standard in this regard. Culinary sorts may be large, provided the types are good. The "bloom" of the fruit or the residue of the spray mixtures on the rind should not be interfered with.

Plates 124 to 129 inclusive are photographs of twelve varieties of apples exhibited at the Ringwood Show, which was held on 17th March, 1917. The four specimens in each dish occupy the same positions in relation to each other that they did when on the show bench. Some of these dishes are from winners of single-dish classes, while others were selected from winning collections of twelve dishes of as many varieties. The names of the varieties in each plate are given below it.

The apple crop of 1916-17 was an unusually light one, and the weather conditions which prevailed during the development of the fruit were not of a favorable character, consequently show specimens were of

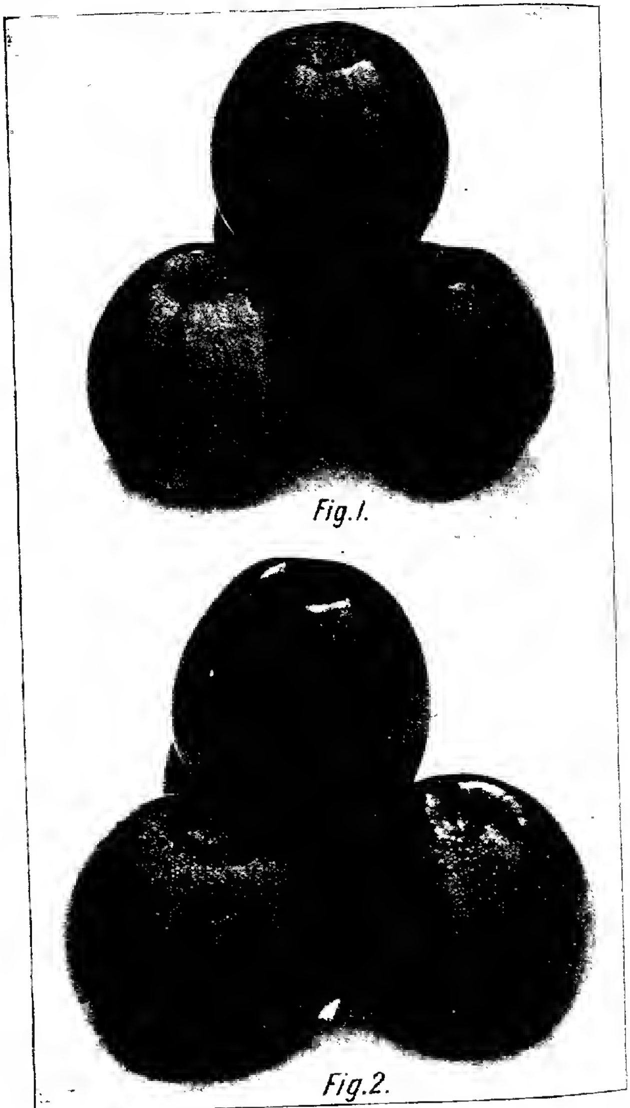


Plate 124.—Fig. 1. Jonathan.
Fig. 2. King David.

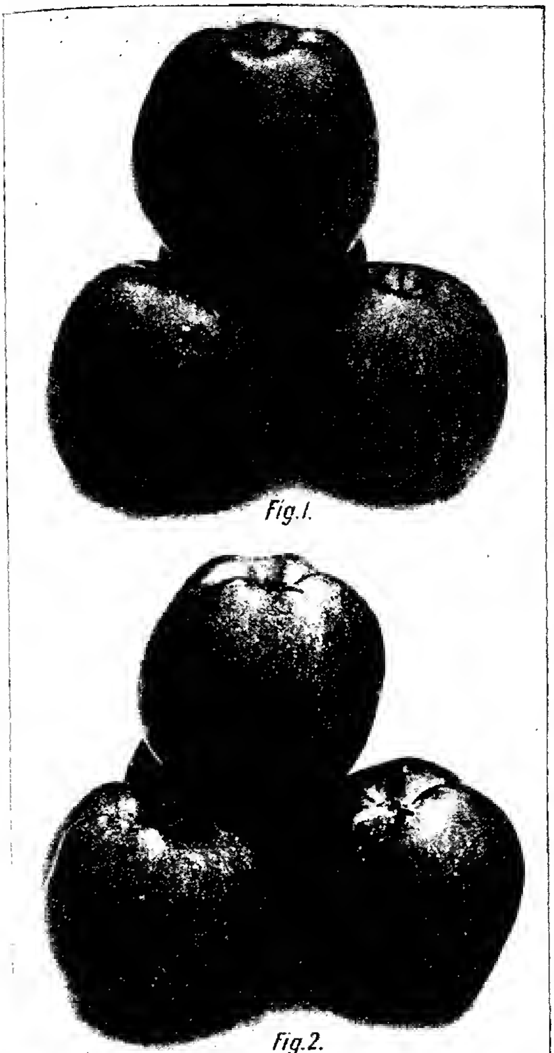


Fig. 1.

Fig. 2.

Plate 125.—Fig. 1—Stewart's.
Fig. 2—London Pippin.

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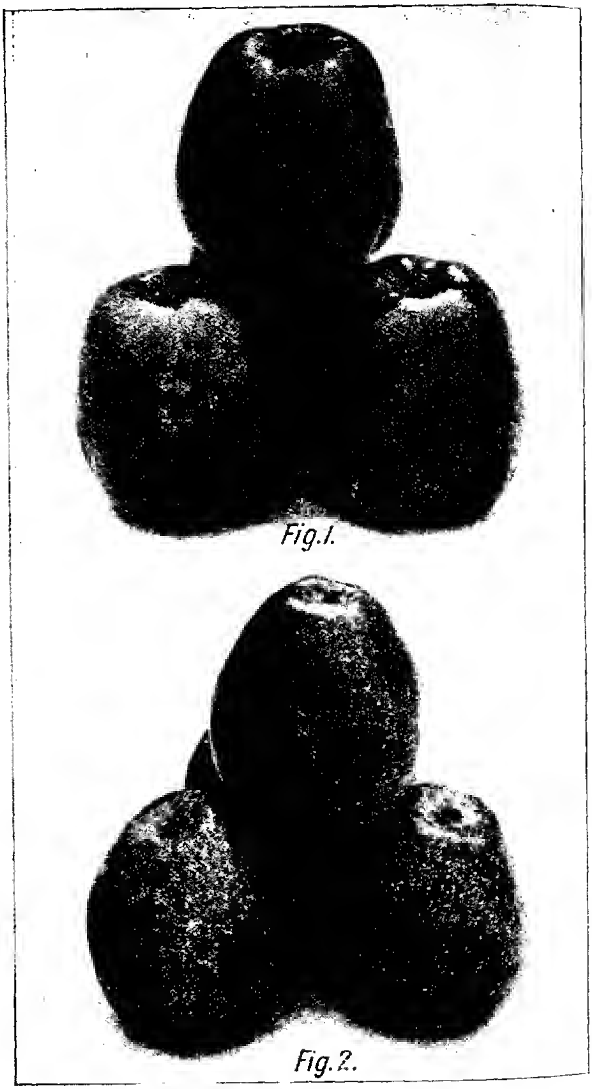

Plate 126.—Fig. 1—Esopus Spitzenberg.
Fig. 2—Buncombe.

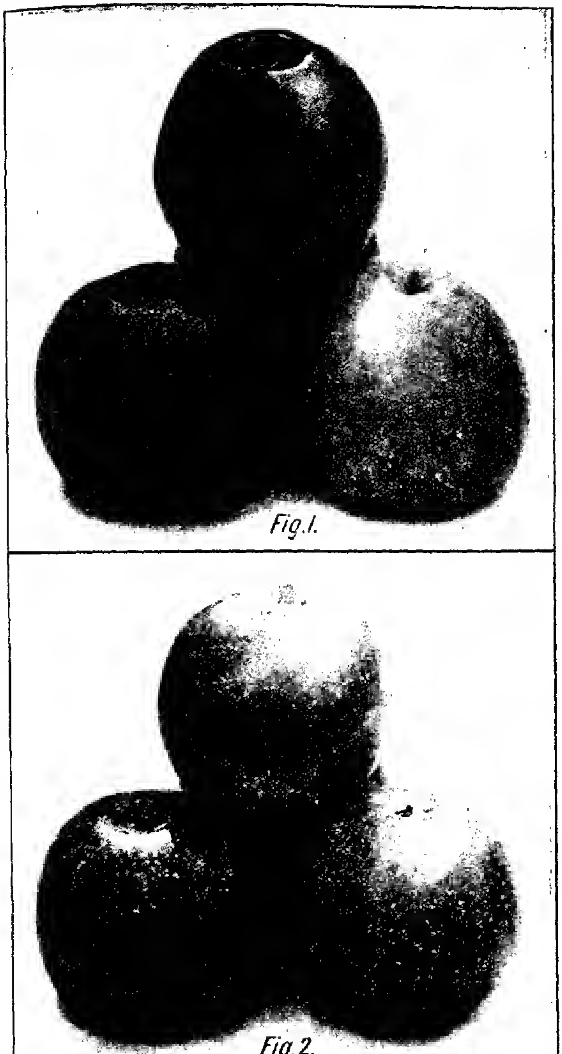

Plate 127.—Fig. 1—Munroe's Favourite.
Fig. 2—Rome Beauty.

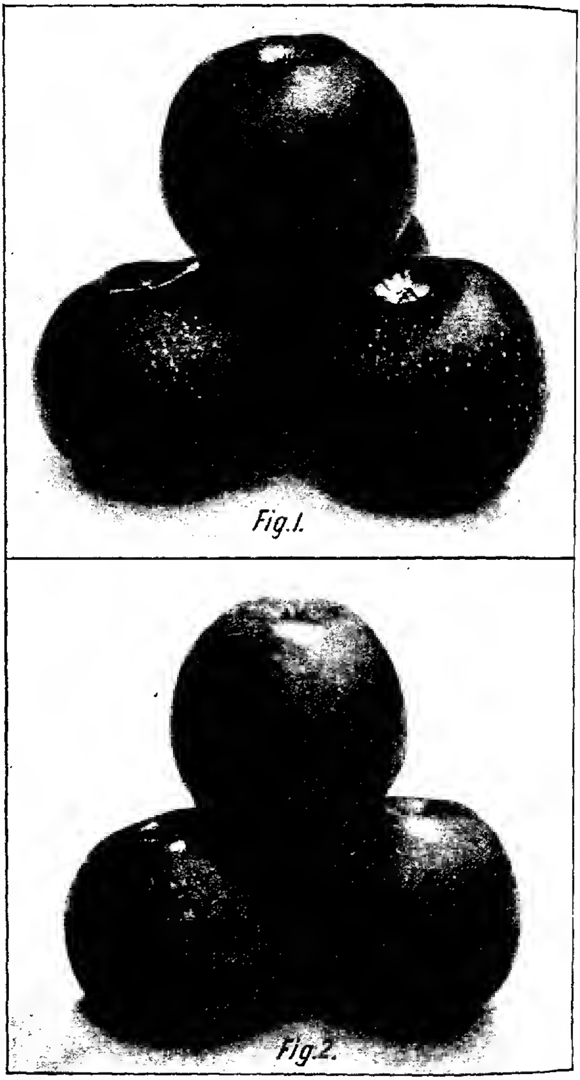

Plate 128.—Fig. 1—McIntosh (Red).
Fig. 2—Statesman.

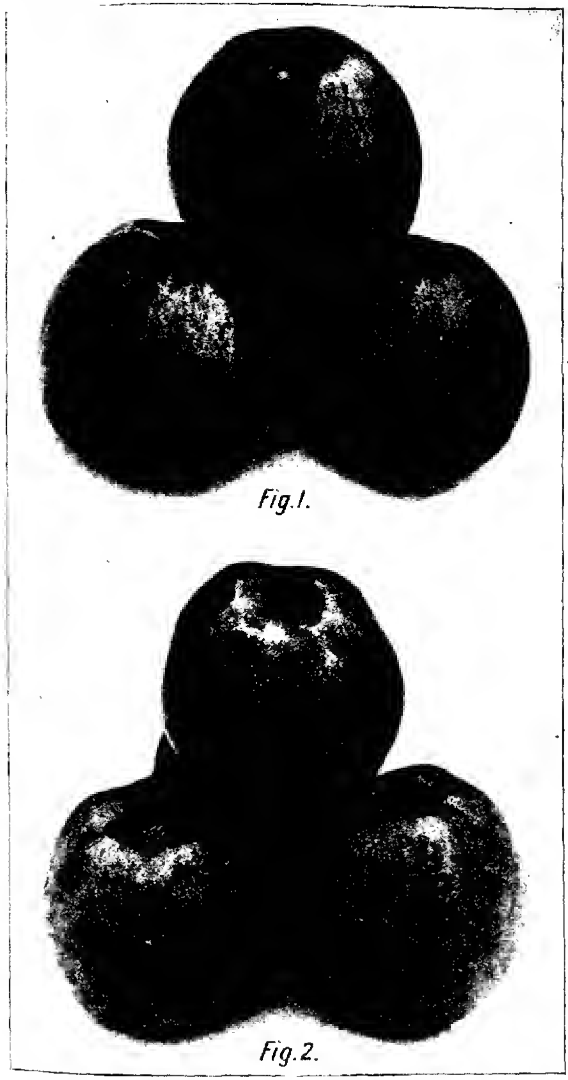

Plate 129.—Fig. 1—Emperor Alexander.
Fig. 2—Reinette de Canada.

a standard inferior to those exhibited during previous years of heavier crops.

The habit of the fruit of some varieties is to grow rapidly and to ripen quickly, whereas other varieties pass through a slow process of development to maturity. These are known as early and late varieties respectively. The Early Margaret is one of the first to ripen; it matures from the blossom in about 79 days. The Sturmer Pippin is one of the late sorts, and it often takes 227 days to mature, from the time of flowering. Then there are the mid-season varieties, like the Gravenstein, while others, such as the Jonathan, develop fairly quickly, but retain a hold on the tree until late in the season.

At the commencement of the 1910-11 fruit season the writer requested a number of orchardists in the Evelyn district, in which perhaps the largest number of varieties of apples grown in Victoria are cultivated, to furnish lists of dates on which their apples were picked that season. The following list of 58 varieties has been compiled from the growers' reports and other data in the possession of the writer, and shows the dates of full bloom, approximately the dates on which the fruit was picked, and the number of days required for its development. The dates of picking in the different localities vary somewhat, but those given in the table represent the average for the whole district.

Variety.	Date of Full Bloom.	Date when picked.	Number of Days involved in Development.
Adams' Pearmain	12–10	7–4	177
Alfriston	10–10	20–3	161
Anna Elizabeth	10–10	21–3	162
Ben Davis	20–10	27–4	189
Buncombe	18–10	13–5	207
Carolina Red June	11–10	10–1	91
Cleopatra	17–10	8–5	203
Cox's Orange Pippin	12–10	23–2	134
Devonshire Quarrendon ..	12–10	19–1	99
Dougherty	20–10	22–5	214
Duchess of Oldenburg	4–10	5–1	93
Dumelow's Seedling	18–10	29–4	193
Early Margaret	12–10	30–12	79
Emperor Alexander	18–10	31–1	105
Esopus Spitzenberg	16–10	19–4	185
Fillbasket	13–10	6–2	116
Foster	12–10	1–3	140
Gladstone	16–10	4–1	80
Golden Russet	15–10	11–3	147
Grand Duke Constantine ..	18–10	16–3	149
Gravenstein	14–10	19–2	128
Hoover	20–10	20–4	182
Jonathan	17–10	1–5	196
King David	13–10	1–3	139
Kirk's Admirable	12–10	18–3	157
Lady Carrington	18–10	1–3	134
Late Wine	15–10	30–4	197
Lord Nelson	7–10	15–1	100
Lord Wolseley	25–10	30–4	187
London Pippin	27–10	21–4	176
Lord Suffield	13–10	11–1	90

Variety.	Date of Full Bloom.	Date when Picked.	Number of days involved in Development.
Mellon's Seedling	10–10	30–4	202
Munroe's Favourite	8–10	3–4	177
Newtown Wonder	12–10	21–4	191
Northern Spy	18–10	14–4	178
Peasgood's Nonsuch	25–10	10–2	108
Pomme de Neige	16–10	1–5	197
Prince Bismark	14–10	1–5	199
Reinette de Canada	4–10	18–4	196
Ribston Pippin	14–10	20–4	188
Rymer	21–10	25–5	216
Scarlet Nonpareil	4–10	2–5	210
Scarlet Pearmain	18–10	27–2	132
Senator	16–10	3–5	199
Sharp's Early	2–10	9–1	99
Shepherd's Perfection	8–10	10–4	184
Shockley	13–10	15–4	184
Shoreland Queen	10–10	20–2	133
Smith's Cider	12–10	2–5	202
Stansill	20–10	8–3	139
Statesman	22–10	17–5	207
Stone Pippin	22–10	30–4	190
Sturmer Pippin	19–10	3–6	227
Summer Pearmain	12–10	14–2	125
Summer Scarlet	10–10	7–2	120
Twenty Ounce	13–10	11–5	210
William's Favourite	22–10	17–1	87
Yates	14–10	10–5	208

Picking the Fruit.

When picking the fruit care should be taken that none of the fruit buds or spurs which are to carry the next or succeeding years' crops be destroyed. This applies more particularly to spurs near the base of the leaders and to varieties which produce below the normal amount of these growths. The fruit should be carefully handled when it is being picked or packed, as bruised specimens soon commence to deteriorate when stored. The fruit stalks should not be removed from the apples, particularly those which it is intended to store for a long period, as their removal often causes a breaking of the rind in the locality of the stem. This enables the spores of various fungi and bacteria to find a lodgment in the wounded parts, which soon commence to decay. The Rome Beauty is one of those most subject to deterioration of this kind.

The Autumn Tint.

When the trees have been relieved of their fruit the sap which is subsequently elaborated in the leaves is used to complete the building up of the fruit buds for the following year, and also to assist in maturing the young wood growths. When these objectives have been attained the leaves change colour and assume their beautiful autumn tint, then they soon fall and allow the trees to commence their winter rest.

(To be continued.)

SPRING GRAFTING OF THE VINE.

By F. de Castella, Government Viticulturist.

The season having arrived for spring or ordinary grafting, it is opportune to describe the method by which ungrafted resistant rootlings planted a year ago can be grafted to viniferas, or, in other words, transformed into fruit-producing vines.

For the benefit of those unfamiliar with vine culture, it may be explained that the presence of phylloxera no longer renders it possible to grow European vines on their own roots, as was always done in earlier days. In all districts where phylloxera is to be feared, our vines must now be worked on resistant stocks, just as apple growers have found it necessary to work their apples on a blight-proof stock, capable of resisting the woolly aphis, an insect belonging to the same group as phylloxera.

A resistant vineyard may be established in two ways—

1. By planting already grafted vines, bench grafted, and struck in a nursery. These are usually termed grafted rootlings.
2. By planting the vineyard with ungrafted resistant rootlings, which will be grafted the following season with the European or "vinifera" scion, from which it is desired to obtain fruit. The operation is in this case known as field grafting (sometimes also termed vineyard grafting) to distinguish it from bench grafting, so termed from the operation being performed at a bench or table in a workshop.

The relative merits of the two methods have given rise to much discussion. Plantation with grafted rootlings permits the elimination of all faulty unions when lifting in the nursery, thus insuring an absolutely even vineyard—what is termed in America a "perfect stand." The advantage of this led to the gradual superseding of the older system of reconstitution by means of field grafting, especially in France, where the cold, wet spring is often unsuitable for the operation.

And yet field grafting also has its advantages; given an absolutely satisfactory graft, it usually results in a more vigorous and fruitful vine than a grafted rootling planted originally at the same time, and this for a simple reason. The field-grafted vine makes its root system the first season, and its union with the scion in the second. During the first season its growth is very vigorous, epecially below ground, more so, in fact, than that of a grafted vine, the union of which, no matter how perfect it may be, presents a slight, though real, obstacle to free sap flow, resulting in somewhat less powerful root development. In other words, the field graft is hardier. During the drought of 1914, several cases were recorded where all ungrafted vines survived, whilst there was more or less mortality among grafted rootlings planted at the same time in the same vineyard. A couple of years later, and after they had been grafted for over twelve months, the greater vigour of the former was very noticeable. Many practical growers who have tried both systems prefer the field graft, both as regards vigour and fruitfulness, at least during the first few years. Later on, according to French authorities, the difference is less noticeable.

But, unless a very high percentage of perfect grafts be obtained, the greater evenness of the vineyard planted with bench grafts will outweigh the greater vigour of the field grafts. Nothing is more unsatisfactory

than a patchy vineyard in which some vines have had to be grafted and re-grafted several times. Such limping vines, as the French call them, cannot become really strong; they die early, leaving gaps which it is impossible to satisfactorily fill owing to the competition of their neighbours.

A very high percentage of faultless grafts is thus a *sine qua non* if a field-grafted vineyard is to be a success. The Yema, or summer bud graft, fully described in the January and February numbers of this Journal, greatly facilitates this desirable result. In the first place, the percentage of success is invariably high, owing to the weather conditions in February, the best time for its execution, being very constant. In the second, it gives very perfect unions, and in the third, it is easy to re-graft, the following spring, the small percentage of vines which may have failed to take, or have not formed perfect unions.

Fig. 1.—Cleft Graft before Binding—after Bioletti. *c*, scion; *cc*, completed graft

It is the method by which these will be re-grafted which forms the subject of the present article, though it is obvious that vines which for any reason were not Yema, grafted last February, may also be grafted in exactly a similar manner during the present spring.

The choice of the actual grafting method depends on the condition of the stock; two cases may present themselves. In the more usual one stock and scion are of different diameters, but they may also be of exactly the same diameter. In the latter case, one has the choice of several different grafts, of which the whip-tongue is the most elegant and generally satisfactory, but in the former and more usual case, the simplest and most practical graft is that known as cleft grafting.

Cleft Grafting.

The ordinary cleft graft of the vine is none other than which was usually employed in former times to change the variety of a block of vines, and to eliminate faulty individual vines, which were the two main objects of grafting in pre-phylloxera days. In such cases, there was always a very considerable difference between the diameters of stock and scion; much more so than when we have to field graft young resistant vines of only one year's, or, at the most, two years' plantation. Such vines are necessarily of small diameter, and, in the special case mentioned above, they may even be of the same diameter as the scion.

The actual method of executing this well-known graft is illustrated in Fig. 1, from which it will be seen that the operation is a very simple one. The stock is cut off square: it is then split right across, and to a depth which depends upon the thickness of the scion, which, after having been trimmed to an elongated wedge, is forced into the cleft, as shown in

the illustration, care being taken that the bark of stock and scion coincide on one side of the latter. The scion is usually a portion of a young cane with two eyes on it. After its insertion, the graft is bound with twine, staked and mounded up. Grafting itself is a simple operation. It is in connexion with matters of detail that care must be exercised, as upon a few points which might, at first sight, appear to be of secondary importance, depends the success or failure of the graft.

When to Graft.

Vines may be cleft grafted from August to November in Victoria. Late September and October is usually the most satisfactory time of year. It entirely depends on the season. The sap of the vine commences to rise in August, and once this is in movement, successful grafting is possible, provided subsequent conditions of warmth and moisture are suitable. Union takes place through the common callusing of the cambium sections of stock and scion. Callus only forms under certain conditions. It requires a minimum temperature of about 60 degrees F.; below this the graft cannot take, though, if properly mounded up, the scion can long remain dormant, awaiting sufficient warmth for knitting to take place. It is far better, however, to postpone grafting until conditions are quite suitable. Freshly-cut surfaces callus most readily, and the danger of excessive moisture, which may even cause the scion to rot or die, is avoided.

As regards moisture, excess rather than scarcity is to be feared. Callus growth is not exacting in this respect; it is most abundant in sand containing only 5 per cent. of moisture, whilst even at $2\frac{1}{2}$ per cent. it is ample. The scion always receives sufficient moisture from the stock if this is properly "in sap" when grafted; if the soil used in mounding is quite dry, so much the better. Irrigation should never follow grafting, as inexperienced growers are sometimes inclined to think beneficial. A watering may with advantage be given a fortnight before, but never shortly after grafting.

It is obvious that early grafting, if the season permits, is to be preferred. If the scion can start into growth with the first rush of vegetation made by the stock, more growth, better growth, and a more rapid, complete, and perfect union are assured. If weather conditions are such that the stock can only be cut back in November, or after it has made abundant new growth, it is compelled to make a fresh start, its vegetation thus receiving a check which causes subsequent growth to be less vigorous than that of an earlier-grafted vine. The check thus caused is, however, of far less consequence than the damage which would result from cold, wet weather immediately after grafting.

It is thus evident that a definite time for grafting cannot be arbitrarily fixed: everything depends on the season. Grafting is essentially a fine-weather operation. It is cold, wet weather occurring immediately after it which is fatal. A drought is far better than a wet spring: best of all is warm, sultry, cloudy weather, but without rain. In a general way the following rule may be given—in a dry, warm spring, graft as early as possible; in a cold, wet one delay grafting until October, or even November.

Professor Ravaz recommends early grafting in the case of stocks which do not take very readily, such as Rupestris du Lot, whilst stocks which take very easily, such as Riparia, 420A, &c., may be grafted late

Age of Stock.

All authorities are agreed that the younger the stock the more perfect the union, and, consequently, the greater the durability of the graft. Hence it is very generally recommended that resistant stocks should always be grafted the second spring following their plantation; that is, fifteen months afterwards. Many practical growers, however, prefer allowing the stock to remain another year, or twenty-seven months after planting, before grafting. To allow it to remain longer is a fatal mistake, which, nevertheless, is sometimes made. Old resistants are much more difficult to graft than old viniferas. In the case of some stocks, such as Rupestris du Lot, it is almost impossible to get satisfactory results if grafting be delayed beyond the second season. It is no doubt better to delay for a season than to graft too weak a yearling; but the general rule is that it is better to graft too young than too old stocks.

Grafting during the same season vines are planted is, in fact, frequently recommended of recent years in France. This is described as the Etienne Marès method. It is very suitable on rich land where stout rootlings may, in fifteen months, acquire such strong development as to render grafting unsatisfactory, owing to the excessive vigour of the stock. M. Marès recommends autumn plantation—November or December—which is equivalent to May or June here. Plantation should be made during winter, at latest, so that the soil may set before growth commences in spring. The stocks should be grafted as soon as the shoots are half-an-inch long. Professor Degrully* states that a block thus established was superior to one grafted fifteen months after plantation, the percentage of success was higher, and the unions more perfect. This block was equal, but not superior, to one planted with grafted rootlings at the same time. The percentage of successful grafts was from ninety-six to ninety-seven, all unions being very satisfactory. He recommends this course more particularly for strongly-growing stocks such as Rupestris du Lot.

This method, which has not yet been extensively used in Victoria, merits a trial. Its suitability, no doubt, depends on the season. If this be favorable to very active growth and extra strong rootlings have been planted, it should have much to recommend it. It should prove very suitable under irrigation, in which case very vigorous growth can be relied on. Where watering is impossible, it may not prove so practicable. Under these conditions, the second season after plantation has sometimes to be awaited before the stock has made sufficient growth for grafting.

Cutting Back of Stock.

When grafting, it is well to first cut off the stock, the scion being prepared afterwards; the latter is liable to dry out rapidly whilst the stock is abundantly supplied with sap. This sap is, in fact, often too abundant, especially in the case of very vigorous stocks. If copious "bleeding" occurs, it is better to cut back the stock three days, or even a week, before grafting. This preliminary cutting back should be executed an inch or so above where it is intended to cut it finally.

The stock should be cut off somewhat above the surface of the ground in order to avoid trouble from scion roots later on; a couple of inches

* *Progrès Agricole*, 19th November, 1911.—Description by Professor Degrully of an inspection of M. Marès's vineyard made by him in company with a Commission of the Societe Centrale d'Agriculture de l'Hérault. Reconstitution had here been affected by means of grafted rootlings and field grafting carried out five months after plantation and also fifteen months after plantation

above the surface level is the most convenient height; if higher, an inconveniently large mound will be required. If bleeding be not excessive, the stock may be finally cut off at the moment of grafting.

The final section must be made with care; in the case of a preliminary shortening, all that is necessary is to avoid cutting too low down. The final cut may be made with knife, secateur, or saw; a knife is best, but a secateur is more convenient, and provided it be sufficiently sharp, it will properly serve the purpose. Select a nice, straight side of the stem where the scion can be so placed that its cambium sections and those of the stock may coincide exactly. Usually one side of the young vine will fulfil this condition better than another; twisty, curved surfaces rarely result in a good graft. Where choice is possible, this spot should be so selected that, after the graft is completed, the scion buds will point in the direction of the trellising wires, and not at right angles to them.

The secateur must be used horizontally, and with blade below and jaw above. The blade (not the jaw) must be applied to the side where the scion will be inserted. These precautions will minimize injury to the cambium layer which, when the vine is well in sap, as it should be for successful grafting, is soft, gelatinous, and easily broken, as is shown by the facility with which bark can be separated from wood at this time. Cambium is a layer or tissue, and not a fluid, as was once thought. The less this vitally-important issue is damaged, the better are the prospects for callus formation. If the stock be a very large one, a saw may be used. It should be fine-toothed, and the cut should be trimmed or refreshed with a sharp knife.

MAKING THE CLEFT.

This can best be done with a sharp knife; for very large stocks a chisel is generally used. For stocks of the size usual when field grafting, a razor blade fitted into a stiff, wooden handle will be found convenient; the back being broader than that of a knife blade, is less severe on the hand of the operator, when a large number of grafts have to be executed.

The cleft may be diametrical or oblique; in other words, through the pith or to one side of it. In the latter case the scion must be trimmed accordingly. The stem of the stock is seldom a true cylinder, in which case its section would be circular. As a matter of fact, it is usually more or less irregular; a skilful grafter will often take advantage of this fact to ensure an exact fit.

It is essential to avoid splitting the stock any deeper than the point to which the apex of the scion will penetrate; nothing is more fatal to success than a deep split, in which the scion is practically hanging, and only in contact with the sides of the cleft at the very top. To avoid splitting too deeply, advantage can often be taken of a knot, so that the lump of twisted fibres which here usually occurs, will constitute the bottom of the cleft. This is not always possible, and the absent knot may be artificially replaced by a clove hitch made with a piece of twine—bagging twine if the stock be small, binder twine if stouter—the two ends should be left sufficiently long to bind and consolidate the graft after the scion has been fitted in place.

The cleft should be a true cut, rather than a split, merely following the fibres of the wood. In stock varieties with straight-grained wood, the difference between the two is slight, but some stocks have twisted or wavy fibres, and in connexion with these care is necessary. The cleft

must be made slowly and carefully by giving the knife an oscillatory or see-saw movement, so that it will cut its way evenly instead of splitting irregularly as a blunt wedge would.

THE SCION.

Scions must be carefully selected; all that was stated in connection with the Yema graft (see *Journal* January, 1917) applies with equal force in the case of cleft grafting. They must consist of thoroughly ripened canes of the previous season's wood, neither too stout nor too slender, and presenting little pith; their diameter depends largely on the size of the stocks. They must be free from all traces of disease, such as Black Spot or the markings left by Oidium.

The condition of scion wood as regards sprouting of the buds, is of importance. We have seen that the stock must be "in sap" when grafted: quite the contrary is necessary in connection with the scion, which must be in as backward a state as possible. It must be removed from the vine whilst this is still quite dormant, and before any sap movement takes place.* The scions must be kept dormant until grafting time. If the buds are too far advanced they may develop into shoots before knitting has taken place; such premature shoots usually die out, leaving the scion depleted for another start. The most usual, and a very satisfactory means of keeping scions dormant, is by stratifying them in almost dry sand in a cool place. Tied in bundles of twenty-five or so and buried horizontally in pure sand, so dry that it will not "ball" when sqeezed in the hand, in a cellar or other cool place, they may be kept in a dormant state even until November. If cool storage is available, there is no more suitable method of preservation. Stratified in sand, or even in very slightly moist spruce sawdust, at a temperature of 35 to 40 deg. F., they can be kept in excellent condition for the best part of a year. Before use, the scions should be placed for about a day with their butts in clean water, so that they may absorb the moisture they may have lost.

The length of the scion depends on the length of its internodes. It is rather a question of the number of eyes than one of actual length. Though a single eye would seem sufficient, most practical growers find that a scion with two eyes gives the best results. A single eye scarcely provides sufficient outlet for the whole growth of the stock; with two eyes, there is a second one to fall back on in the case of damage to the first. More than two eyes is neither necessary nor desirable, though perhaps permissible with short jointed wood. If very long jointed, good grafters sometimes use single-eye scions; too long a one would expose to the risk of the graft being shifted accidentally before complete union, with necessarily fatal results.

TRIMMING THE SCION.

This may be done in a great many ways. The essential point is to ensure a thoroughly well-fitting graft, so that the scion completely fills, on one side at least, the cleft. The most usual way is as shown in Fig. 1, the scion being prepared by removing, just below its lower bud, and on each side, a fragment of wood, in such a way that it is cut to a more or less elongated wedge. Each cut should be made with one movement

* French authorities have recently recommended scion removal in either very early or very late winter: times at which the canes are richest in reserve substances. If cut very early special care is necessary in preservation; late winter removal exposes to risk of being caught by the bursting of the buds.

of the knife, so as to leave an absolutely plane and even surface. The skill of the grafter mainly consists in making these two cuts efficiently. They should be made in such a way that the wedge is slightly wider on the bud side than on the opposite side. Care must also be taken not to allow the knife blade to engage too deeply at first. In other words, a circular shoulder on either side should be avoided. One of these cuts can, with advantage, be rather deeper than the other, so that the apex of the wedge consists of solid wood; in other words, the scion must be trimmed so that the pith is only seen on one side of the wedge, on which side is immaterial. It will depend upon the obliqueness of the cleft made in the stock (see Fig. 2, *a* and *b*). The practical grafter will find that no two scions will require trimming exactly alike, but slight variations will be needed in each case to insure an absolutely neat fit. The length of the wedge also varies according to circumstances. In the case of stout stocks, it must be long and thin to avoid splitting too deeply. With thinner stocks, the tissues of which are more flexible, it may be shorter. Slowly-knitting stocks, as Rupestris du Lot is considered to be in France, need a longer wedge than those which unite more rapidly, such as 420A.

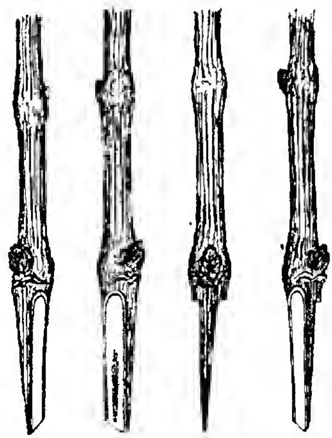

Fig. 2.—*a* and *b*, the ordinary method of trimming the scion for the Cleft Graft; the wedge is slightly thicker on the side where the bud is situated (front), the pith is only showing on one side of the wedge. *c* a shouldered scion; *d* a scion shouldered on one side.

Thus prepared, we have what may be termed the normal scion used in cleft grafting, but several departures are often made from it. Sometimes the scion is shouldered, as shown in Fig. 2 *c*. This can most conveniently be done with a special grafting machine, though it can also be executed with a knife, one with a narrow blade being most suitable. The advantages of the shouldered cleft are that a fairly thick scion may be used without requiring a widely-split cleft, and that the cambium sections of stock and scion can be made to fit very neatly. Sometimes the scion is shouldered on one side only, as shown in Fig. 2 *d*.

In the great majority of cases the normal wedge is to be preferred, though with fairly stout stocks and large scions, when the tendency is for the stock to split too deeply, the shouldered scion may prove more convenient. Intermediate between the two we have the scion shouldered on one side only, which may prove useful in certain cases.

With any of the above modes the wedge should be so situated that the bud is immediately above its upper or thick end, and as near to it as convenient.

Fitting of Stock and Scion.

Of quite equal importance to their proper preparation is the efficient fitting of the judiciously trimmed scion into the stock prepared to receive it. This should be dexterously effected by one single movement, care being observed that the bark is not separated from the wood on either stock or scion, as might easily happen if the assembling of the two were done in a hesitating or clumsy manner. If the stock be large, a small wedge of bone, or some hard wood, may be used to slightly open the cleft at the opposite side to that where the lower bud of the scion will be situated. To facilitate description we may call this side of both stock and scion the "front"; that opposite to it being referred to as "back." The wedge would thus be inserted at the back of the cleft. With stocks of moderate size—the most usual case—this temporary wedge is unnecessary: the apex of the trimmed scion can be easily inserted into the top of the cleft.

This being done, the scion is pressed home, steadily but firmly, with the right hand, the fingers of the left hand being used as a guide to ensure the barks of stock and scion being level at the front of the graft. The scion must be pressed sufficiently far to entirely fill the cleft, but not far enough to split the stock any deeper than the point to which the knife penetrated when making the cleft. Some variation is permissible in fitting the scion. This may be done as shown in Fig. 1, two small half moons of woody section, one on each side of the scion, being left uncovered. It may, however, be pushed in deeper, so that the scion sections are entirely hidden by the sides of the cleft; for this to be possible, the cuts made when trimming the scion must be absolutely plane sections, without curve or shoulder at the top of the wedge. Such latitude is, of course, impossible in the case of a shouldered scion (Fig. 2, *c* & *d*). What is essential is that the scion should absolutely fill the front of the cleft without any gaps or unfilled spaces.

The most vital point of all, however, is the proper fitting of the cut surfaces along the front of the graft. Hitherto, for convenience, we have only referred to the need for bringing the barks of stock and scion level. In reality, something more is required, and this must now be explained in detail. *It is not the outer, but the inner, surface of the barks, in other words the cambium layers, which must correspond.* The vital importance of this tissue was pointed out in the article on the Yema graft (see *Journal* for February, 1917). The cambium layer, which everywhere separates bark from wood, is the only portion of the cut surfaces of stock and scion where new tissues can form; being very thin, the section where it is cut is little more than a line, and these lines on both stock and scion must be in contact in the greatest measure possible; the more completely do they coincide, the more perfect will the graft be. *Unless they meet in one point at least, no union is possible and the graft must fail.*

Now, in field grafting, the bark of the stock is nearly always thicker than that of the scion; with stocks planted a year or more before grafting, it may be considerably thicker. It thus follows that the outer surfaces of the bark of stock or scion, in a properly executed cleft graft, will seldom be quite flush; that of the stock will be slightly sunken in when viewed from the front. The thicker the bark of the stock, the greater the difference of level. A skilful grafter carefully examined the bark thicknesses of stock and scion and makes allowance accordingly. It is often recommended to slightly cant the scion when

inserting it, so that its apex or point will be a shade too far in, and the broad or upper part will be a little too far out. The cambium sections will then intersect one another in the central portion on both sides of the front of the graft. Such a cant must, of course, be exceedingly slight, otherwise the cambium sections will meet along too small a length; the greater the extent of their junction the more perfect will the ultimate union be.

Needless to say, the cambiums must meet on both sides of the front: a graft knitted on one side only never proves satisfactory. If the cleft be oblique, the scion must be trimmed accordingly; after a few trials a novice will find little difficulty in securing a perfect fit.

As regards the back of the graft matters are very different; it is only in the special case when stock and scion are of equal diameter, that cambiums can be made to meet both at front and back. If this be possible, four cambium sections will coincide and a very perfect union will result, almost equal to that of a whip-tongue graft. In the great majority of cases, however, the stock is larger than the scion, and knitting is only possible at the front of the graft; in spite of this drawback, quite satisfactory and durable unions are usually obtained. Figs. 3 and 4 will give an idea of the manner in which a cleft graft usually knits. When viewed from the front (Fig. 3) a neat union is to be seen, but the appearance from the back (Fig. 4) is less satisfactory: sometimes it is almost alarming, more dead than live tissue being in evidence. As time goes on new tissues are formed abundantly, and after a year or two the appearance of the union will be vastly different. Stock and scion then appear to be almost continuous, the proportion of dead tissue at the back of the graft being quite small in proportion to the now greatly enlarged stem. The scar at this point, though still noticeable, is small and really less objectionable than would be the one caused by the suppression of a large arm on an old vine. It is evident that the smaller the stock when grafted, the smaller will this scar be on the full grown vine; this, in fact, constitutes one of the chief arguments in favour of grafting young stocks.

BINDING AND STAKING.

A skilfully executed graft, especially if an opportune knot be situated at the bottom of the cleft, requires no binding. Nevertheless it is safer to tie; a couple of turns are made around the completed graft with the two long ends of the twine used to prevent splitting when the cleft was made, and the whole is securely tied up. Novices are inclined to use too much string, winding it round so as to form a continuous bandage about the graft; this interferes with callus formation, and is therefore undesirable. Four strands—the clove hitch previously mentioned, and two additional ones to bind the graft—are all that are really necessary. The strands should not touch one another, but should be a slight distance apart.

Grafting wax and similar preparations are not only unnecessary, but injurious. They hinder rather than promote callusing, which is favoured by moderate aeration; no better medium can be provided than the mound of loose soil which will presently be described. Formerly, it was customary to plaster the graft with well kneaded wet clay, of the consistency of soft putty; sometimes this was mixed with cowdung. Such treatment, although it does not help knitting, may, in a wet season,

Fig. 3.

Fig. 4.

Figs. 3 and 4.—Photographs of the usual type of cleft graft at the close of the season following its execution. Fig. 3 shows the "front" now completely knitted and callused over. Fig. 4 shows the "back"; the wood at the upper part of the cleft is now dead. Grafts usually take thus when the diameter of the stock is considerably greater than that of the scion. Though less perfect than the result of a successful "whip tongue" graft, the graft here figured will result in a vigorous and fruitful vine.

prove of service in excluding excessive moisture, the greatest obstacle to success in grafting. Nevertheless, practical grafters have now very generally discarded all such forms of protection.

Staking when grafting is to be recommended; the vigorous shoots sent out by the scion oppose a large surface to the wind, which may even detach the whole scion, as the new tissues of the graft remain soft and tender for a considerable time. A temporary stake, 30 inches long, is all that is required, though vines intended to be trained on stakes can, with advantage, be now permanently staked. Staking not only obviates damage from wind, but insures erect canes, one of which will be utilized to form the main stem of the vine. Tying up, if only to a short temporary stake 18 inches or so above the ground, will obviate unsightly crooked stems which are always an eyesore in a vineyard.

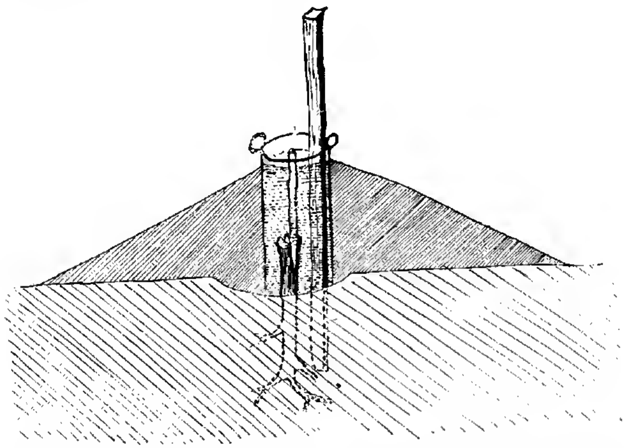

Fig. 5.—Method of mounding in stiff soil. A temporary tube is placed round graft and stake, and filled with sand, the ordinary soil of the vineyard is mounded up around the tube, which is then withdrawn. The tie which binds the graft has not been figured.

Mounding.

The mound which completes the operation of grafting needs but little description if the soil of the vineyard be loose or sandy; it should completely cover the top of the scion and be made so that the batter is something like one in two. Care should be taken that the scion is not displaced or disturbed in any way.

On stiff land it is difficult to make a suitable mound. Even if well pulverized the soil soon becomes compacted by rain, being rendered liable to crack and allow too much air to get to the graft. The crust which often forms also opposes an obstacle to the free growth of the young scion shoots which, being unable to break through, become twisted and contorted in a most undesirable way.

A simple expedient, which appears to have been first proposed by Felix Sahut, enables this difficulty to be overcome.* All that is necessary is a tin or galvanized iron tube about 12 inches high and 6 inches in diameter—a 7 lb. golden syrup tin, the bottom of which has been removed, will do—and a load or so of sand. The method is illustrated in Figure 5. The tube is placed around the graft and its stake. It is then mounted up outside, to the level of the top of the scion, with the ordinary soil of the vineyard, which should be broken up and pulverized as completely as possible; the interior of the tube is then filled with sand so as to completely cover the graft and the whole of the scion. The tube is now withdrawn and placed around the next graft, which is similarly treated, and so on.

In wet springs it is possible that greater certainty of success would be insured by covering the mound with a hollow cone made of waterproof paper and held in place by a couple of spadefulls of earth. If the upper side of this cone were painted black the graft would, owing to absorption of heat, be kept warm as well as dry. Such means of protection has not yet been practically tried; the idea occurred to the writer during the compiling of these notes, and the suggestion is made in the hope that it may prove of use to intending grafters during the present spring, which, so far, does not promise very well for field grafting.

Thus executed and protected the graft may be left to itself for a while. When growth starts the tie may require cutting and the young shoots will need tying up; later on suckers and scion roots will need attention and removal, operations which will be dealt with in a subsequent article.

* *Les Vignes Americaines, leur greffage et leur taille*, by Felix Sahut, 1887, p. 370. This work was awarded a gold medal by the French National Society of Agriculture.

SOIL BACTERIA AND THEIR ENEMIES.

Evidence is gradually accumulating that one great factor of soil fertility lies in the relation which obtains between the numbers of bacteria and of protozoa which live and move, and have their being in the soil. Broadly speaking, says the *Gardeners' Chronicle*, the bacteria of the soil may be regarded as the gardeners' best friends, and the protozoa—the antagonists and destroyers of the bacteria—as his enemies. If for one reason or another the protozoa increase beyond certain limits, the bacteria fall off in numbers, and the soil, the fertility of which depends in a measure on bacterial activity, is no longer in a condition to supply plant food—it falls sick. Hitherto, the evidence in support of this interesting and important hypothesis has been presumptive, rather than conclusive. It was largely of the nature of an inference drawn from the effects of partial sterilization of the soil. As is now well known, sick soil may be restored to health—that is, may be rendered fertile once again—by exposure to a temperature of about 120 degrees Fahr. At that temperature the active, "thin-skinned" soil protozoa are destroyed, but the "thick-skinned" more resistant of the soil bacteria are not. Thus, when the soil cools down again, the bacteria find no opposition to their increase. They multiply rapidly, and in the course of their growth and activity set free large quantities of material—and particularly nitrogenous material—of a kind suitable for the nutrition of plants.—The *Leader*, 12th May, 1917

ANOTHER GOOD DAIRY FARM.

E. J. Turner, Dairy Supervisor.

From the number of men who are still to be found keeping dairy cows without any method or system in the management of their stock, it is evident that there is a lot of persistent work yet to be done to wake them up to the possibilities of their occupation. There are, however, a number who may be classed as thoroughly up-to-date dairy farmers, who are making every endeavour to get the best results from their work, and whose farms may well be held up as examples of what others might just as easily attain.

One such as this is the "Cresslea" farm, on Tarwin Lower, which is situated about 6 miles from the Buffalo railway station, and is owned and managed by Mr. A. T. Warren.

This farm has an area of 320 acres, and has been in the possession of the present owner for about four years. The land is mainly river flats, sown down in the rough with rye grass and strawberry clover, and is flooded at times during the winter and early spring. A considerable amount of work has been done by Mr. Warren since purchasing the property by clearing out tea-tree and tussocks, which has greatly increased the carrying capacity of the land.

The farm is subdivided into seven paddocks, four of which, containing 190 acres, are used for the dairy herd, and the remaining 130 acres are occupied by the dry cows and young cattle. The dairy herd usually runs to about 75 head of milking cows and two pure Jersey bulls, together with about 70 head of young stock, as about 30 or more heifer calves are reared from the best cows each year. There are also about 50 pigs kept on the place, and seven horses are used to carry on the farm work. The dairy cows are nearly all Jerseys, and Mr. Warren has culled his stock until he has built up a very satisfactory herd for the production of butter. The average butter fat test for the whole herd for the year works out at 4.6, which means that the milk from this farm is more than 25 per cent. richer in butter fat than is required by the Board of Health standard, and shows what can be obtained by careful breeding and selection.

As the farmer has to find for each cow sufficient fodder to enable her to milk to her full capacity, it is not a wise policy to keep cows that will give only 3.5 per cent. of butter fat when a very much better return could be obtained without increase in the labour or cost of production. Still, there are hundreds of farmers turning the separator for 3s. per 10 gallons of milk when they might be getting 4s. from the same quantity. These are the men who know too much to learn anything more about dairying.

The cows on the farm are all dehorned, and this makes for greater docility in the herd, both in the yards and milking shed, and eliminates the possibility of udders being injured through horn wounds, which cause a considerable loss yearly among horned cattle.

Another point noted which tends to the quiet contentment of this herd is that no dogs are used in the paddocks or yards. Driving milch cows with cattle dogs is very prevalent on many dairy farms in this district, and it is a practice that makes cows restive and cross-tempered in the bails, which is not conducive to an even flow of milk.

The cows are all rugged during the cold weather, which, Mr. Warren states, "means half the feed." In other words, without the rugging the cows would not be able to give anything like the returns—possibly not more than half that they yield now—in the cold weather, and much more richer food would have to be given to obtain anything like the same results from cows not kept warm and comfortable by rugging.

The dairy work is carried out solely by Mr. Warren and family, there being no hired hands employed in the work, and the cows are thus not subjected to any change in milkers.

Great care is taken in keeping the cows' udders and teats sound and free from sores. Each udder is washed with warm water before milking, and the milkers use as a lubricant for their hands an ointment prepared of mutton fat, boracic acid, and castor oil. During the last three years I have carefully examined the udders of all the cows in the herd, and have not found even the slightest induration or blemish, which satisfactory condition has been mainly brought about through dehorning the cows, gentleness in handling them, and other careful management. This farm has a first-class water supply in the Tarwin River, the water from which is conveyed to the various paddocks by windmill and pipes. Here, again, is another very important matter in the management of a dairy herd. Not only do heavy milking cows require a regular supply of clean water, but the more convenient it is for them the better for the owner. The banks of many Victorian creeks and rivers are steep, and if dairy cows have to scramble up and down a steep bank, and possibly wade through mud up to the brisket, they will only go to drink when absolutely forced by thirst. Further, in such places, the banks usually cut up, and the cows, having to wade to the water, get their udders and teats wet and dirty; and where such conditions exist chapped and sore teats are sure to be found. Where water troughs are, there is also less chance of young or quiet cows being injured by others. A bullying cow will frequently rush another up or down a steep river bank, to the injury of the weaker one. Thus, everything the owner can do to make the life of the dairy cow as quiet and reposeful as possible will assist her in producing her maximum of milk and butter. To heavy milking cows at any time, but particularly in hot weather, a handy supply of clean drinking water is quite as important as a good food supply.

The milking shed at Mr. Warren's farm is fitted with twenty bails, which are well bricked and drained, and the shed is also supplied with water from the river, which allows of the milking shed and separator room being flushed out daily.

In order to supplement the grazing during the summer months, about 10 acres each of maize and millet are grown. A similar area of oats for hay is also grown each year for horse feed mainly, but any surplus is fed to the dairy herd during the winter months.

The land for the millet is ploughed in September, worked thoroughly to a fine tilth, and sown in October at the rate of 6 lbs. of seed to the acre. The seed is mixed with 50 lbs. of bonedust and super. per acre, sown from the manure box, and cross-drilled; and the crop is ready to feed off when the grass commences to dry in January. The feeding off is generally repeated three times during the season, and this keeps the cows up to their regular milk yield until the maize crop is ready for

cutting. This latter crop is cut and carted out and fed to the cows in the paddock, usually lasting about ten weeks.

Not many dairymen fully realize the advantages of keeping up an unbroken milk supply of the herd during the early summer months. If a cow is permitted to slacken off at this season, through shortage of succulent fodder, it is almost impossible to bring her back again to her full flow. Therefore, to maintain a good summer yield it is very important to feed greenstuff liberally at this time. Half feeding is possibly even worse than not to hand feed at all, as it encourages the cows to linger about, instead of grazing, and they do not get a full feed altogether. When the spring of the grass comes after the autumn rains, if the cows meanwhile have had a timely supply of green fodder, the dairying season will be extended by at least two months, and it should also be remembered that the price for butter fat is usually good at this period of the year. In consequence of the drought in the autumn of 1914, butter fat was bringing about 2s. 6d. per lb. in the month of May of that year. Mr. Warren was then sending five cans of cream weekly to the Stony Creek Butter Factory, the price per can exceeding £4, though most of the other dairy herds in this district were then dry, and in some instances dairy farmers were even buying butter for their own household use. A reference to the returns of this farm as published below will show that during the dry spell in January last they were highly satisfactory, and they will compare favorably with any farm on the far-famed Tarwin Meadows.

Another great advantage of the system of growing fodder for hand feeding the cows is that they are kept in good condition during the winter months, and when they come in to full profit in the early spring they are in good flesh, and can milk to their best right from the start. Good grazing paddocks are here reserved for the cows when not in milk, which is in marked contrast to the custom of many dairy farmers, who turn their cows out into the scrub country during the winter months, with the result that, when the milking season commences, they are in such poor condition that the spring is nearly over before they really come to their full yield; and in many instances it is very questionable whether they ever recover, as their constitution is weakened through poverty. Throughout the State a considerable number of cows are lost every year through the lack of better management in providing sufficient autumn fodder for them, and dairy farmers will do well to note the several features mentioned here, which continue to give such good results on this particular farm.

From the three Berkshire sows kept for breeding purposes and mated with a Yorkshire boar, the average number of pigs per litter last year was eleven, and a return of £227 was obtained last season by the sale of their progeny. Notwithstanding the definite advantages a dairy farmer derives from breeding his own pigs, this side line of dairying is often neglected. A farmer should seldom have to buy store pigs, as on most farms some sugar beet could be grown each year, and if well cared for an acre would carry at least 40 pigs for three months, which would mean that this small crop would last the breeding stock through the winter, when skim milk is scarce, and if there were any quantity of surplus roots beyond what was required for the pigs they are excellent fodder for cows. The average dairy farmer too often depends on the

market to obtain his store or young pigs. Consequently, when there is a flush of milk in the spring, there are more buyers than sellers, and the profit a farmer can obtain from pigs when he has to purchase under these conditions is usually very small. It is system that makes success in dairy farming, and for a farmer to take a sporting chance in purchasing pigs in the open market, when many other dairymen are endeavouring to do likewise, is not good business.

The following are the returns obtained by Mr. Warren for sale of cream to the Stony Creek Butter Factory, as shown by his fortnightly cheques, and it will be noted that the total of £1,080 6s. 2d. for cream represents a yearly return of £14 8s. per cow for the whole herd of 75 cows, not taking into consideration the return from his pigs, which, in terms per cow, represents an increase of a further £3 per cow, demonstrating that there is something to be gained by following out a good system in dairy farm practice:—

July, 1915, to June, 1916.

1915.	£	s.	d.	1916.	£	s.	d.
July 10	9	7	0	Jan. 8	55	17	0
,, 24	10	19	3	,, 22	57	6	8
Aug. 7	11	2	8	Feb. 5	57	5	8
,, 21	17	4	6	,, 19	55	6	9
Sept. 4	20	12	11	Mar. 4	46	16	1
,, 18	29	17	9	,, 18	50	7	0
Oct. 2	31	17	4	April 1	50	17	6
,, 16	53	3	4	,, 15	47	5	6
,, 30	61	4	11	,, 29	43	14	10
Nov. 13	61	3	3	May 13	38	2	0
,, 27	57	19	7	,, 27	35	10	5
Dec. 11	82	4	1	June 10	25	3	7
,, 25	58	7	8	,, 30	11	8	11
				Return from sale of cream ..	1,080	6	2
				Sale of fat cows	100	0	0
				Sale of pigs	227	0	0
				Total	£1,407	6	2

SPACE SAVING.

METHODS ADOPTED IN CUTTING AND PACKING MUTTON, TEG, AND LAMB.

In order to consider the question of the saving of refrigerating space on steamers, &c., an Inter-State Conference of Meat Exporters was held at Sydney recently, when the following methods of cutting and packing mutton, &c., were agreed upon:—

1. The carcass to be dressed, trimmed, &c., in accordance with the usual methods observed in the preparation of mutton, teg and lamb for export.

2. The kidney fat to be removed from all mutton and teg. In regard to lamb, the kidney fats, and necessarily the kidneys, are to be removed

in cases where the best results in space saving would be negatived by such fat remaining in the carcass.

3. The carcass to be now semi-frozen, after which it shall be divided at a point 1 inch below what is known to the trade as the "chump" bone. (*See* Diagram 1.)

4. In the cutting, which will therefore be generally done in the freezing-room, the use of the saw is considered preferable to that of the knife.

5. The leg is now inserted in the chest cavity, either sideways (Diagram 2) or squarely and with the back and tail exposed (Diagram 3).

6. The package may then be hard-frozen as it stands on the floor supported by the shins and neck, or it may be hung on the rail in any manner which best suits the conveniences at the disposal of any particular works.

Diagram 1.

The black band represents the division between the leg and the trunk.

Diagram 2.

The leg is inserted in the chest cavity sideways.

Diagram 3.

The leg is inserted with the back and tail showing outwards.

7. Wrapping may be carried out in the usual manner.

Note.—In the dressing of the beast, exporters should see that the skirt is completely removed. This is important.

VICTORIAN RAINFALL.

Second Quarter, Year 1917.

District.	—	April.	May.	June.	Quarter.
		Points.	Points.	Points.	Points.
Mallee North	District Mean.. ..	11	178	154	343
	Normal	76	112	126	314
	Per cent. above normal	..	59	22	9
	„ below „	86	..	..	..
Mallee South	District Mean.. ..	29	142	168	339
	Normal	98	130	171	399
	Per cent. above normal	..	9	..	..
	„ below „	70	..	2	15
North Wimmera ..	District Mean.. ..	52	265	123	440
	Normal	122	160	212	494
	Per cent. above normal	..	66	..	..
	„ below „	57	..	42	11
South Wimmera ..	District Mean.. ..	65	317	151	533
	Normal	152	183	269	604
	Per cent. above normal	..	73	..	..
	„ below „	57	..	44	12
Lower Northern Country	District Mean.. ..	33	212	343	588
	Normal	116	169	213	498
	Per cent. above normal	..	25	61	18
	„ below „	72	..	..	..
Upper Northern Country	District Mean.. ..	50	213	433	696
	Normal	148	192	258	598
	Per cent. above normal	..	11	68	16
	„ below „	66	..	..	..
Lower North-East ..	District Mean.. ..	113	449	714	1,276
	Normal	173	249	374	796
	Per cent. above normal	..	80	91	60
	„ below „	35	..	..	..
Upper North-East ..	District Mean.. ..	247	758	1,302	2,307
	Normal	289	407	602	1,298
	Per cent above normal	..	86	116	78
	„ below „	15	..	..	..
East Gippsland ..	District Mean.. ..	373	118	156	647
	Normal	237	249	312	798
	Per cent. above normal	57	..	..	..
	„ below „	..	53	50	19
West Gippsland ..	District Mean.. ..	398	382	367	1,147
	Normal	286	299	348	933
	Per cent. above normal	39	28	6	23
	„ below „	..	..	..	..
East Central	District Mean.. ..	330	424	479	1,233
	Normal	273	301	337	911
	Per cent. above normal	21	41	42	35
	„ below „	..	..	..	..

VICTORIAN RAINFALL—*continued.*

District.	—	April.	May.	June.	Quarter.
		Points.	Points.	Points.	Points.
West Central	District Mean.. ..	147	199	288	634
	Normal	194	215	242	651
	Per cent. above normal	..	..	19	..
	„ below „	24	7	..	3
North Central ..	District Mean.. ..	137	354	471	962
	Normal	189	246	329	764
	Per cent. above normal	..	44	43	26
	„ below „	28	..	..	..
Volcanic Plains ..	District Mean ..	135	334	165	634
	Normal	189	216	268	673
	Per cent. above normal	..	55	..	..
	„ below „	29	..	38	6
West Coast	District Mean.. ..	273	510	222	1,005
	Normal	240	294	357	891
	Per cent. above normal	14	73	..	..
	„ below „	..	..	38	13

N.B.—100 points = 1 inch.

The rainfall during April, over the northern portions of the State, was very scanty, and at many places in the Mallee no rain whatever fell. In Gippsland, and more especially the eastern areas where some heavy falls occurred the results were much above the average, and the coastal districts also fared well. Temperatures were unusually low and frosts frequent. As many disturbances of an Antarctic character visited the State during May, bringing with them showery weather, the whole of Victoria participated in the rains, and totals well above average were experienced. More especially was this the case in the North-East and Wimmera districts, where rains were recorded on almost every day in the month. As the mice plague was still as severe as ever, particularly in the north, seeding operations were being postponed, as experience has proved that it is useless to sow as the mice destroy the seed almost as soon as it is sown. Stock were in splendid condition owing to the abundance of grass still available and the new growth produced by recent rains, and as lambing percentages everywhere were excellent, the prospects with regard to the much desired increase in flocks were all that could be desired in this direction. The June rains were again heavy in the north-east and north, and the weather was too wet to be appreciated, the excessive rains causing severe floods; all the rivers running high, and some of them much over the danger level. In the Wimmera, Western, and in Eastern Gippsland the rainfall was below the normal, and in the former district more rain was badly needed, as crop prospects were not encouraging. Stock generally were in good condition, excepting in Gippsland, where they were only fair.

H. H. HUNT,
Commonwealth Meteorologist.

ORCHARD AND GARDEN NOTES.

E. S. Pescott, F.L.S., Pomologist.

The Orchard.

SPRAYING.

The peach aphis will now have made its appearance in orchards which were not sprayed with the red oil emulsion in the winter. The tobacco solution will now be required, and this may be sprayed on as strongly as the grower wishes. If possible, a second spraying should be repeated quickly after the first operation, so as to kill any aphides previously protected by the others, or any that may have only been weakened by the first operation.

The time has also arrived when spraying is needful for the prevention of all fungus diseases, such as shothole or scab, black spot, leaf rust, leaf curl, &c. In the case of these pests, "prevention better than cure" is the invariable rule; and to delay beyond the correct period the application of the necessary sprays is to court disaster. For black spot of the apple and pear, the spraying should be performed as soon as the earliest flowers are opening. For shothole and scab the time to spray is before the flower petals expand; and the spraying may be repeated, if necessary, after the fruit has set.

For rust and leaf curl the spray should be applied before any sign of the trouble appears on the foliage; thus, if the fungus were present during the previous season, it will be necessary to spray early to combat it successfully.

The basis of all the successful fungicides is sulphate of copper or bluestone. Bordeaux mixture (a mixture of bluestone, lime, and water, known as the 6.4.40 formula), is used; the materials and quantities being 6 lbs. bluestone, 4 lbs. lime, and 40 gallons water.

Another spray, and in some locations equally successful in its results as the Bordeaux mixture, is the copper-soda spray, the proportions being 6 lbs. bluestone, 8 lbs. washing soda, and 40 gallons of water. In each case the materials should be separately dissolved, and then evenly and simultaneously mixed in a third vessel.

It is very urgent that the lime should be thoroughly fresh and quick, otherwise the spray mixtures will give very inferior results. A second necessary point is that the copper sprays should be used as soon as they are made. Where the grower does not wish to make his own spray, there are quite a number of ready-made Bordeaux pastes and Bordeaux mixtures already on the market, which can be used with satisfactory results. In fact, the use of these has become fairly general, and it is not now the practice for growers to make their own sprays.

GENERAL.

It is most important that ploughing should be completed as early as possible. In the past, it has very frequently happened that, owing to delaying the ploughing, the orchard and the fruit crop have both suffered very considerably. It is absolutely necessary to cultivate the surface early, to take advantage of the moist surface and consequent

easy ploughing; and also to conserve as large an amount of moisture in the soil as possible. The longer the ploughing is delayed, the less amount of moisture is retained in the soil for summer use. Deferred ploughing certainly means dry soil, enfeebled trees, and diminished results. Early ploughing gives exactly opposite results; the earlier the ploughing, the more soil water is conserved.

When the ploughing is completed, the clods should be crushed, and the land harrowed, so that a fine earth mulch may be obtained. The orchard surface should be kept as level as possible, and no irregular ridging or furrows should be allowed.

All cover crops planted to supply humus to the soil should now be ploughed in. If the plants are of a leguminous nature, the best time to plough these in is when they are in full flower. If the growth has been at all excessive or rank, the crop may be rolled before ploughing; or it may be cut or mowed with a mowing machine. Every care should be taken that the plants should be distributed evenly over the ground, and large quantities in a mass should not be ploughed under. Artificial and stable manures may also be given to the trees at this time. These should be applied before ploughing.

Grafting.

The work of grafting should be completed early in the month. The most useful method of reworking old trees is to cut the head right off, leaving only the stump. Then grafts can be put in according to the fancy of the grower. The old method of cleft grafting has been superseded by the bark or crown graft. The latter method does not cause any damage to the wood and thus, with care, no rotting can take place. The best method of bark grafting is the saddle graft; that is, the graft is inserted in the bark and a strip of bark is carried right across the trunk and inserted in the bark on the opposite side. This method is much slower than the ordinary bark graft, but it insures a much quicker healing over the old stump.

Vegetable Garden.

The vegetable plots should be cleaned from all weeds, having the light weeds dug in and the stronger ones pulled out and rotted in the compost heap. The surface should be worked up to a very fine tilth after digging; it must be kept constantly loose with the hoe to keep the soil cool; and prior to digging it will be advantageous to give a top dressing of lime.

If the weather be dry or windy, all newly-planted plants should be frequently watered. In transplanting seedlings, it is a help to dip the whole plant in water before planting.

Any seedlings that are ready may be planted out; the first crop of tomato plants may be planted out under shelter until the frosts are over. At the end of the month a sowing of French bean seeds may be made. Seeds of peas, broad beans, and beet, cabbage, kohl-rabi, and radish, turnip, cauliflower, lettuce, carrot, parsnip, &c., may be sown in the open. Seeds of melons, cucumbers, pumpkins, marrows, and similar plants may be planted in frames for transplanting after the frosts have gone.

Flower Garden.

After digging, the surface must be kept constantly stirred with the hoe, so as to have it loose and friable for cooling and for moisture-conserving purposes. All weeds must be kept down, as they are robbers of plant food and moisture at this season of the year. Shrubs of all kinds may still be planted out, and these should be well watered after planting. Rose and other aphides must be watched for, and sprayed when they appear with a nicotine spray. Rose scale should be sprayed with lime sulphur wash or with kerosene emulsion. This pest will soon disappear if the bushes are kept open to admit air and the sunlight freely. Rose mildew will now be appearing, and the plants, as well as the soil, should be sprinkled with liberal dustings of sulphur. Sulphide of potassium is also a good specific for this fungus trouble, using it at the rate of 1 oz. to 3 gallons of water.

Cannas, early chrysanthemums, and early dahlia tubers may be planted out, as well as all kinds of herbaceous plants, such as delphinius, perennial phlox, asters, &c. These clumps should be well broken up, and in planting they should be fed with a liberal quantity of stable manure. Beds should be prepared and well dug over for exhibition chrysanthemums and dahlias.

REMINDERS FOR OCTOBER.

Live Stock.

HORSES.—Continue to feed stabled horses well, add a ration of green-stuff. Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses. Feed old or badly-conditioned horses liberally. If too fat, mares due to foal shortly should be put on poorer pasture. Mares with foals at foot should receive a good ration of oats daily. Those intended for breeding, if not already stinted, should be put to the horse. Colts not intended to be kept as stallions should be gelded. Working horses due for a spell should be turned out to grass.

CATTLE.—Except on rare occasions, rugs may now be used on cows at night only. Continue giving hay or straw, if possible, to counteract the effect of green grass. Be prepared for milk fever. Read article in *Year-Book of Agriculture*, 1905, page 314. Give calves a warm dry shed and a good grass run. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Feed regularly with regard to quantity and time. Give a cup of limewater in the milk to each calf, also place crushed oats or lucerne hay in a trough so that they can eat at will.

PIGS.—Supply plenty of bedding in warm well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. Sows suckling young should be well fed to enable them to produce plenty of milk. Give young pigs pollard and skim milk in separate trough as soon as they will take it, and keep them fattening from the start to get them off as early as possible. Give a tablespoonful of bone meal, or half that amount of mineral phosphate, per 100 lbs. live weight in food daily. If pigs are lousy dress them with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect styes. Pig breeding and feeding should be very profitable for a long time to come, and it should be safe to launch out now.

SHEEP.—Shear as early as the weather will permit, and avoid the usual excessive dust in travelling to, and yarding at sheds. Burr and seeds also collect on the fleeces if shearing be left until late in the season, particularly with lambs. Shear all lambs not going for export—they thrive better and make

more growth through the ensuing summer and autumn. Fleeces from well-bred, good-backed sheep should be skirted with care, the better the class of wool the greater the necessity. From fleeces that have become dead and earthy on the backs, remove only the merest stains; there is little advantage in skirting these. It is better management to have ample tables and extra hands skirting closely than to hastily tear off unnecessary wool and then employ men at other tables to sort "broken fleece," "first," and "second" pieces, &c. All stains must be removed from ewes' fleeces, and pizzle stains from the bellies of wethers. Keep separate all coarse fleeces from the finer sorts, and in merinos the yellow and mushy from the shafty and bright. Skirt all hairy thighs from crossbred fleeces. Avoid sending wool to market in long, round-sided bales, known as "sew-downs." Press in a box-press, forming square sides. Brand bales neatly, on one side only, and not with sheep-branding oil, tar, or paint. Stencil plates and branding ink can be obtained on application to the respective brokers.

At first signs of scour drench with turpentine and oil. This preparation is now procurable in emulsion form, and thus the fear of choking is removed. If discharge be dark and accompanied with mucus, yard over night, drench on an empty stomach, repeat again in about fourteen days, and in some cases a third dose may be necessary. Change to new pasture if possible, or give a little grain, whole oats for preference.

Poultry.—The bulk of incubation should cease this month—late chickens are not profitable. Devote attention to the chickens already hatched; avoid overcrowding. Feed with dry mash. Also add plenty of green food to ration, ordinary feeding to be 2 parts pollard, 1 part bran, and a little animal food after the first fortnight. Feed ground grain, such as wheat, hulled oats, maize, and peas, which should be fed in hopper to avoid waste. Grit or coarse sand should be available at all times. Variety of food is important to growing chicks; insect life aids growth. Remove brooders to new ground as often as possible; tainted ground will retard development.

Cultivation.

Farm.—Plant main crops of potatoes in early districts and prepare land for main crop in late districts. Fallow and work early fallow. Sow maize and millets where frosts are not late, also mangolds, beet, carrots, and turnips. Sow tobacco beds and keep covered with straw or hessian.

Orchard.—Ploughing and cultivating to be continued, bringing surface to a good tilth, and suppressing all weeds. Spray with nicotine solution for peach aphis, with Bordeaux mixture for black spot of apple and pear, and with arsenate of lead for codlin moth, in early districts.

Vegetable Garden.—Sow seeds of carrot, turnip, parsnip, cabbage, peas, French beans, tomato, celery, radish, marrow, and pumpkins. Plant out seedlings from former sowings. Keep the surface well pulverized.

Flower Garden.—Keep the weeds down and the soil open by continued hoeing. Plant out delphiniums, chrysanthemums, salvia, early dahlias, &c. Prepare ground for digging and manuring for autumn dahlias. Plant gladioli tubers and seeds of tender annuals. Spray roses for aphis and mildew.

Vineyard.—This is the best month for field grafting. If stocks bleed too copiously, cut off 24 hours before grafting. Make sure that scions are fresh. Placing butts in clean water for a few days before grafting is recommended. Field grafts *must* be staked, to avoid subsequent straining by wind and to insure straight stem for future vine. Stakes are also necessary for grafted rootlings for same reasons. Temporary stakes 3 feet long will suffice. Keep a sharp look out for cut worms. (See *Journal* for July, 1911, and also October, 1913.) Disbud and tie up all vines, giving special care to young plantations. Beware of spring frosts. (See *Journal* for September, 1910.)

Conclude spring cultivation (second ploughing or scarifying and digging or hoeing round vines). Weeds must be mastered and whole surface got into good tilth. Sulphur vines when shoots 4 to 6 inches long.

Cellar.—Taste all young wines; beware of dangerous symptoms in unfortified fruity wines, which may need treatment. Fill up regularly all unfortified wines.

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APPLE CULTURE IN VICTORIA.

By J. Farrell, Orchard Supervisor.

(Continued from page 553.)

Blemish and Surface Inequalities of the Rind.

It has been stated that a lower percentage of good show apples was produced in the 1916-17 fruit season than during previous years. This shortage is to be accounted for partly by the light crop, as well as by the blemish caused by black spot, which appeared in a more virulent form than had been experienced for many years before, and which was caused by the unusually moist atmospheric conditions which prevailed during the fruit's first stages of development. Another factor militating against the production of the usual percentage of show specimens, and also considerably reducing the value of the fruit as a commercial product was the surface inequalities of the rind, for which it is assumed the frequent heavy rains during, and for some weeks subsequent to, the setting, were largely responsible.

It is well known that the more symmetrical and better specimens of the varieties are obtained as the result of cross-fertilization. During the continuance of these rains, however, interpollination was practically suspended, as bees and other helpful insects were unable to establish their system of pollen exchange between the varieties. These objectionable conditions were so general during the 1916-17 fruit season that the writer was unable to find the fruit of any variety completely immune from their influence, while in many instances very contorted forms were observed.

When the ovary of an apple is of normal development; that is, contains five chambers, and the two ovules in each of the chambers are cross-fertilized, and come to maturity, uniform development of the whole of the specimen will invariably eventuate. Whereas, self-fertilized ovules

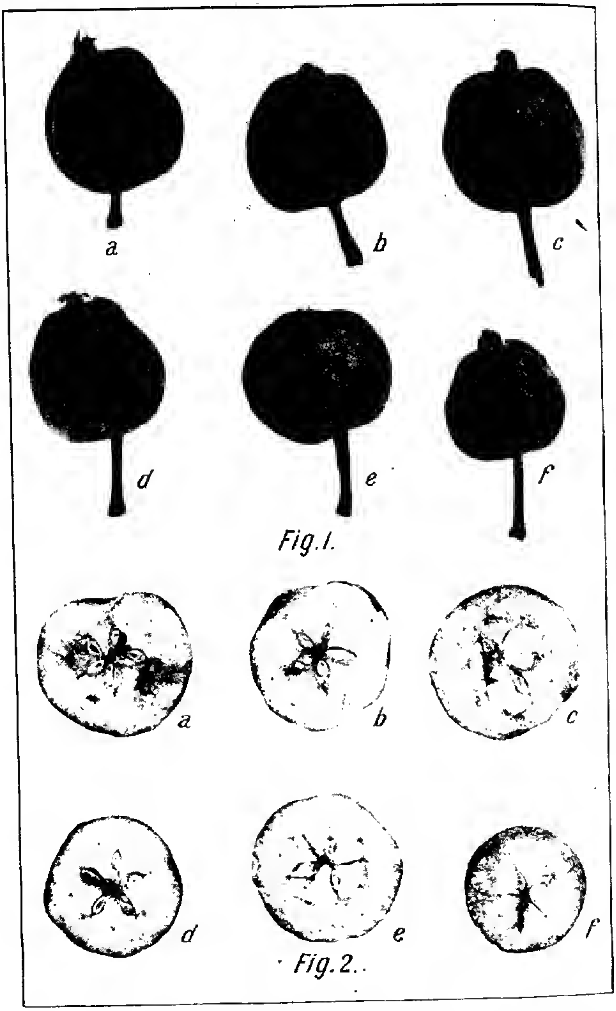


Plate 130.—Fig. 1. Six varieties of apples (natural size) showing inequalities of the rind.

Fig. 2. Transverse sections of apples shown in Fig. 1.

may develop satisfactorily for a while, many of them, later, frequently show signs of aborting, and wither up. This seems to upset the equilibrium of the fruit's development, and small indentations, interspersed with minor protuberances, destroy the desirable sectoral equality of the rind.

Plate 130, Fig. 1, is a photograph of six varieties, Statesman, Pomme de Neige, Rome Beauty, Duchess of Oldenburg, Reinette de Canada, and Yates, lettered *a, b, c, d, e, f* respectively. Fig. 2 depicts cross-sections of the same six apples, and the lettering in their case indicates the same varieties as those named in Fig. 1. To show the surface inequalities in the transverse sections, however, these should have been made nearer to the eyes, as the irregularities are invariably more pronounced in the calyx ends of the fruit, but had this been done, the condition of the ovaries and the positions of the ovules would not have been illustrated. These sections are natural size, and the fruit has arrived at the stage when the ovules commence to wither. The specimens from which these photographs were taken were forwarded to the writer by Mr. L. Pilloud, orchard supervisor in charge of the Gippsland district, in which unusually wet conditions, especially during the commencement of the 1916-17 fruit season, prevailed.

Unusual Variety Irregularities.

Strange though it may seem, most varieties of apple trees produce a preponderating number of irregularly shaped fruit, even in seasons favorable to normal development, typical specimens numbering but a small percentage. The diversity in this aspect of the fruit's features has practically no limit. To the casual observer the ripe fruit on a heavily-laden tree may be remarkable for its apparent uniformity of shape, nevertheless, a person accustomed to selecting show specimens may experience difficulty in finding on such a tree even a single fruit worthy of a place on the show bench to compete in its variety class.

Although these irregularities are of such common occurrence, yet varieties with their own fixed characteristics producing specimens shaped like other kinds of fruits are rare. Plate 131, which gives two specimens of the Shoreland Queen apple, will serve to illustrate the last statement. Fig. 1 is typical of the variety, while Fig. 2 is pear-shaped. The specimens from which this photograph was taken were grown by Mr. F. Finger, of Wantirna, who submitted them to the writer for investigation.

The specimen from which Fig. 2 illustration has been taken was so perfectly pear-shaped, and because of the delicate golden hue that appears in the rind of this variety when ripe, fruit experts, until they submitted it to close examination, mistook it for a pear.

Other Remarkable Phenomena.

While this series of specific investigation relating to the metamorphosis of the apple were being conducted, many phenomena besides the pear-shaped fruit were observed, the more remarkable of which are depicted in the following illustrations. These freaks are more common in the Jonathan than in any other variety, and they most frequently appear in the form of double fruits, with partly perfected, conjoined, detached, or semi-detached ovaries.

Plate 132, Fig. 1 (*a*) and (*b*) are specimens of slightly varied forms; their transverse and vertical sections appear in Fig. 2, and are similarly

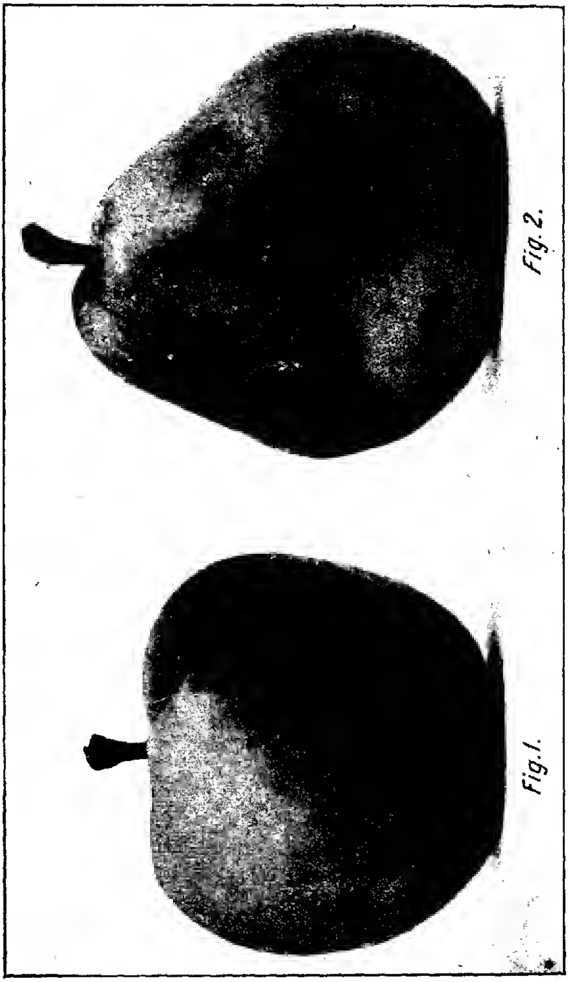


Plate 131.—Two apples of the Shoreland Queen variety.

Fig. 1 is typical of the variety.
Fig. 2 shows a pear-shaped development.

lettered. These show the formation of the double ovaries, and the attachment of the fleshy parts of smaller apples to those of larger ones.

Plate 133 (*a, b, c, d, e*) shows various forms of other Jonathan abnormalities, while (*f*) and (*g*) represent in shape the plum and peach respectively.

These freaks are developed from blossoms corresponding in character and formation with the specimens they produce. This is not generally known, however, and the fruit's change from the normal is most commonly attributed to the action of frost. Another reason given for the altered formation is that when self-thinning out is in progress the little fruits instead of falling to the ground adhere to the healthy ones next to them.

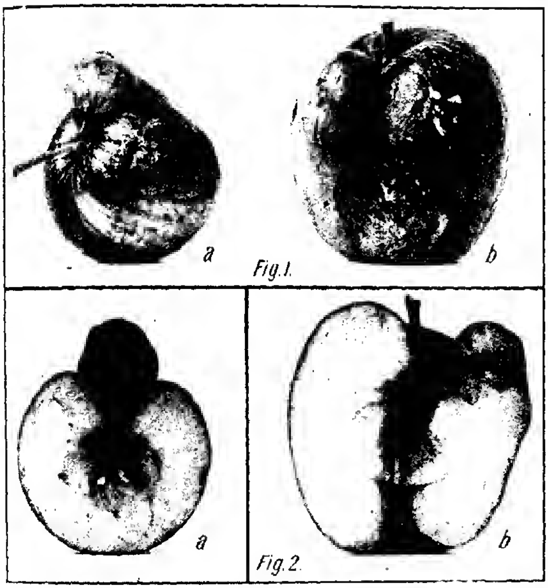


Plate 132.—**Fig. 1. Two apple freaks of the Jonathan variety.**

Fig. 2. Transverse and vertical sections of specimens shown in Fig. 1.

A close study of the vertical sections of the blossoms shown in plate 134 will reveal the fact that the reasons formerly advanced as being the cause of this unusual formation of the fruit were absolutely incorrect. Although it is of regular formation, (*a*) on account of its weak construction produces a small plum-shaped apple like (*f*) in plate 133.* A bloom like (*b*) develops into an apple the shape of that marked (*b*) in plate 133. Blossom (*c*) has no fruit representative among the specimens given. This when fully developed would be simply two apples on the one stalk. Specimens (*d*) and (*e*) are the most common of those which deviate from the normal. They become fruits

similar to (*a*), (*b*) in plate 132, and (*a*), (*d*), (*e*), plate 133. The size of the secondary apple on the side of the larger one is regulated according to the strength and position of that portion of the bloom on which it is produced; thus it is obvious that (*f*) simply becomes an enlargement of the specimen.

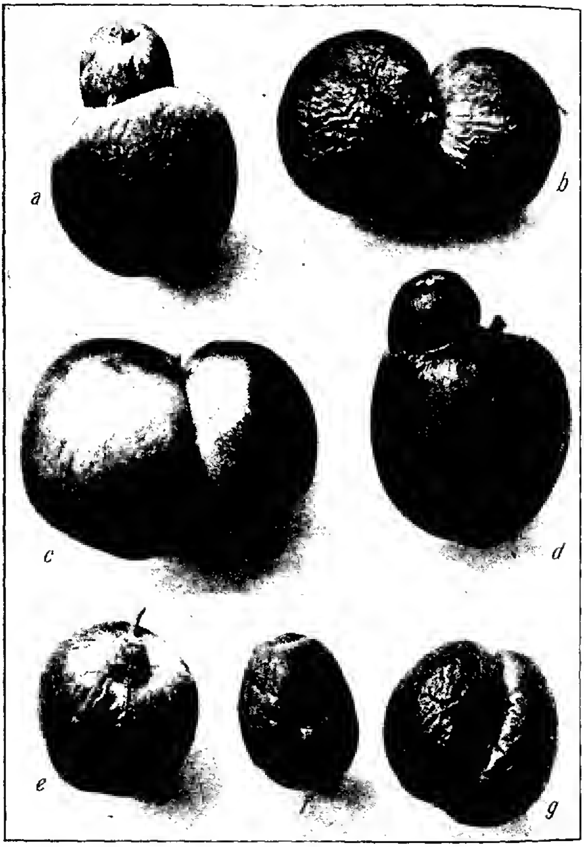


Plate 133.—Other freak conditions of the Jonathan.

The type of blossom from which (*c*) in plate 133 was grown has not been discovered. It is plain, nevertheless, that it is a double one with conjoined ovaries of almost equal strength.

The most remarkable of these specimens is the one marked (*a*) in the bunch of apples in plate 135. Its core consists of eight partly

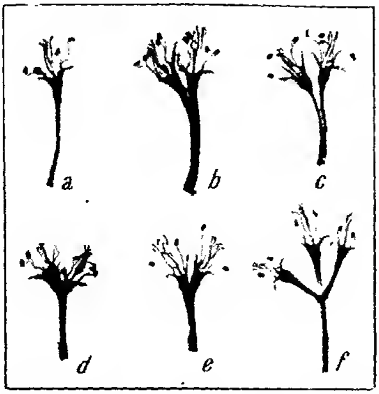


Plate 134.—Six types of Jonathan apple blooms which vary from the normal.

Plate 135.—Large cluster of apples. The specimen marked (a) consists of eight partly developed ovaries connected with each other.

developed ovaries which are connected with each other, and run in the direction of the apple's length as the segments which constitute it show. Large clusters of apples such as this are usually produced on growths resulting from early summer pruning during the previous year, particularly when they culminate in a number of short spurs with highly developed fruit buds on their points. The Jonathan specimen marked (x) in plate 81 is a good illustration of this class of wood and buds.

Plate 136 depicts a Jonathan growth developed as described in the case of (x), but instead of retaining its blossoms until the following year, it burst into flower during the year in which the specimen was produced.

Plate 136.—A growth which resulted from summer pruning and which bloomed the same season.

Irregularities of the Tredika Variety.

A few years ago Mr. W. P. Chalmers, orchard supervisor in charge of the Maryborough district, forwarded to the writer for examination some blooms of rare botanical construction found on a tree of the Tredika variety growing in Mr. R. Firns' orchard at Amphitheatre. Mr. Firns subsequently supplied specimens of apples from the same tree, also blossoms and fruit from another tree of the same variety, which gives blooms of normal development. On being examined, Mr. Chalmers' specimens were found to be of a rare pistilliferous character. Ordinary pistilliferous apple blossoms have the normal number (five) of pistil divisions, but without petals and stamens. The number of

pistil divisions contained in the specimens under review, however, varied, in the different flowers, from eleven to nineteen.

Plate 137 shows nine blossoms of this variety. Specimen (*a*) is from the tree which produces flowers of normal development only, while (*b*) to (*i*) depict variations in the pistilliferous flowers. Each of the

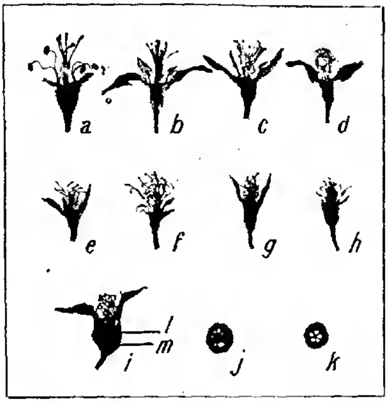


Plate 137.—Perfect and pistilliferous flowers of the Tredika apple.

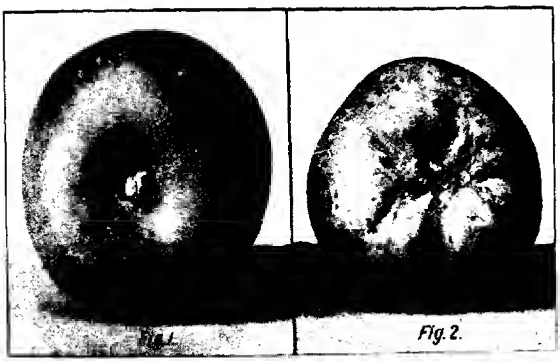


Plate 138.—Fig. 1. Specimen from tree which yields perfect flowers.
Fig. 2. Specimen from tree which produces pistilliferous blooms.

latter class contains two ovaries, one above the other. Five of the centre pistil divisions, in each instance, develop into an ovary with five chambers in the usual position which the cross-section (*k*) taken from the point (*m*) in specimen (*i*) illustrates. The remainder of the pistil divisions of each flower, whatever the number may be, form a circle

around the five mentioned. They penetrate a short distance through the nectary and develop into a second ovary with small circular chambers which correspond in number with the pistil divisions, and they contain imperfect ovules. The cross-section (*j*) taken from the point (*l*) illustrates this development.

Photographic illustrations of two apples produced from the classes of flowers first described are given in plate 138. Fig. 1 was picked from the tree which yields perfect flowers, and Fig. 2 came from the

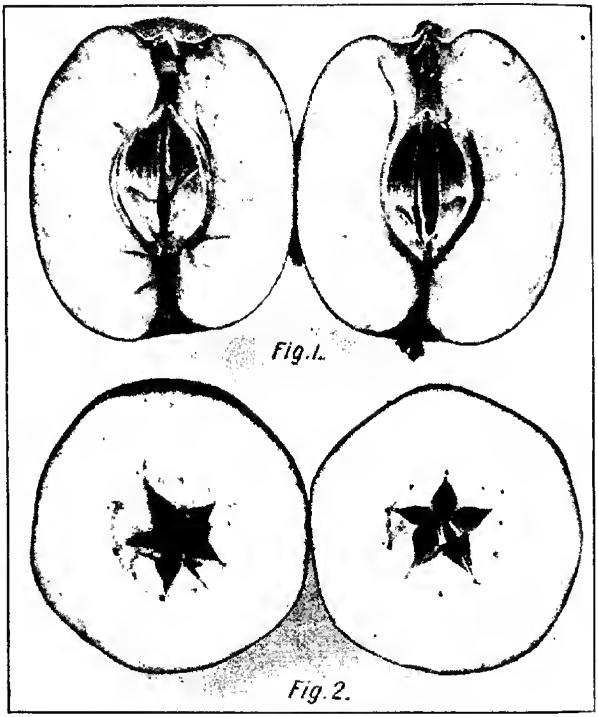


Fig. 1.

Fig. 2.

Plate 139.—Figs. 1 and 2. Two pipless apples, Shoreland Queen variety.

one which produces pistilliferous blooms. The latter is evidently the result of cross-fertilization, as the flowers of this tree contain no stamens.

The Coreless Apple.

No doubt the wish to possess a coreless apple has been father to the thought that inspired enthusiastic orchardists in the past to anticipate its production. But the date of its accomplishment as a commercial proposition is, in the opinion of the writer, remote indeed. Now that

we better understand the botanical construction of the apple flower and the essential functional operation of its sexual organs in order that an apple may develop, it would seem that the phenomenon necessary to bring about the change, is probably outside the realm of possibility. Nevertheless, as we know not what treasures Nature has in store for us, it is inadvisable to make a dogmatic statement in this regard.

It is not generally known that an apple may come to maturity when its ovules are fertilized, but will wither up as the fruit commences to develop. Such fruits, however, when they appear, are usually produced from late blossoms, and are rather more elongated in shape than seasonable specimens of the same variety, which invariably contain their pips.

Plate 139 illustrates two apples of the Shoreland Queen variety. Fig. 1 was cut vertically through the centre of the ovary to show its condition and the little withered ovules in its lowest extremity. Compare the shape of this apple with the typical one of the same variety

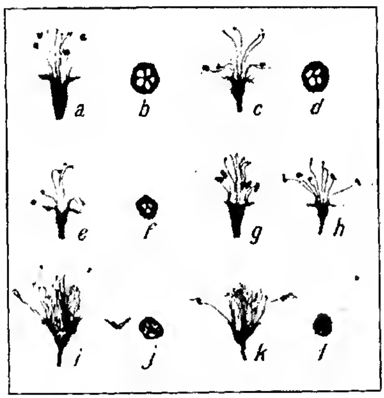


Plate 140.—Various features of apple tree blossoms and fruits.

in plate 131, Fig. 1. Fig. 2 shows transverse sections of another apple picked from the same tree giving this aspect of the ovary. These apples were produced from late blooms. They were picked and photographed on 24th May, 1917, when they were fully matured, but had not reached the ripe stage.

So far, the pips have been dispensed with, but the ovaries are somewhat larger than those found in normal specimens. The membraneous substance which constitutes their ovary walls is also thicker and tougher than that of apples which ripen in season. Then comes, what might appear to the less observant horticulturist, the possibility of rendering the core in the apple non-existent, by reducing the number of pistil divisions, and consequently the ovary chambers, to vanishing point. Some varieties, the Gravenstein in particular, often produce flowers with ovaries below the normal size. Flowers with pistils made up of

four, three, and two divisions and with corresponding numbers of ovary chambers have been found on trees of this variety. Without reaching the point of core extinction, however, it is amply apparent that were it possible to produce such an apple it would be of low commercial value.

In arriving at this conclusion the writer bases his calculations on the fact, that as the ovary becomes smaller through the reduction of its chambers, the quantity of the fleshy part becomes correspondingly diminished, and its quality is impaired. Consequently this aspect of the matter may be dismissed without further comment, though, in the interests of horticultural science, it may be desirable to further explain certain variations noticed in apple blossoms while the series of systematic experiments and investigations were being conducted.

Plate 140 depicts a few of these specimens—(*a*) is blossom of the Bellflower variety showing normal development of the pistil, (*b*) is a cross-section through the ovary of a young fruit of the same variety showing a corresponding number of ovary chambers. The Gravenstein flower (*c*) has only four pistil divisions, and (*d*) is a section of a young fruit of the same variety showing the chambers reduced to four also. The flower (*e*) and the cross-section (*f*) are of the three division character, and are also Gravenstein. The three fruit cross-sections were of the same age when mounted to be photographed. It is plain that as the core is reduced in size general degeneration of the fruit follows. The pistil of the London Pippin flower (*g*) is in seven divisions, while that of the Rome Beauty (*h*) has only four. The general formation of the pistil is often altered when its divisions deviate from the normal. To determine this, compare (*h*) with Fig. 2 (*c*), plate 118, published in this Journal of August last.

Now it is clear that the best and most shapely apples are produced from flowers of normal construction, and that a reduction of the correct number of pistil filaments and consequent ovary contraction is accompanied by degeneration of the fruit. It is equally clear that when the filaments of the pistil exceed five, a correspondingly undesirable condition is set up. This may be understood from the reference made to the Tredika variety.

We have even a better illustration of this condition in the beautiful flowering apple tree, *Pyrus Spectabilis*, which produces large semi-double flowers with many petals and pistil filaments. The fruit, which is mostly composed of core, is small and inferior. Specimens (*i*) and (*k*) are sections taken from flowers of the *Pyrus Spectabilis*, when their petals were removed. As many as thirty-seven styles were counted in flowers of this species.

In cross-sections (*j*) and (*l*) are depicted the core-filled rinds of the young fruit.

(*To be continued.*)

EVAPORATION OF APPLES.*

By J. S. Caldwell, Fruit By-Products Specialist, State College of Washington Agricultural Experiment Station.

THE KILN EVAPORATOR.

It may be said in the outset that in Western New York the kiln evaporator is universally used, having completely displaced the various types of tower or stack evaporators described by Bailey and Corbett. Among the reasons given by operators for the abandonment of towers are that the fuel and labour cost per unit of output were greater, as was the initial cost of construction, and that the constant introduction of fresh fruit retarded the drying of that already in the tower, lengthening the process and permitting secondary changes in the fruit which resulted in an inferior product largely devoid of flavour. They claim for the kiln evaporator a lower cost of construction and operation and a decidedly improved quality of the product. There can be no question that the first of these claims is true, as the labour required to operate a kiln is considerably less than is necessary for other driers of equal capacity. Also, the quality of the dry fruit is generally better and more uniform, but it must be emphasized that the character of the product depends upon the watchfulness and skill of the operator at least as much as upon the type of plant employed.

In its essential features the actual drying room of the kiln evaporator presents little that will be wholly new to those familiar with the construction of the hop kilns once so common in certain parts of the State. The drying unit is two stories in height and in the smallest plants is usually 20, much more rarely 18 or 22 feet square. In larger plants the building is divided by walls continuous from ground to roof into a single or double row of units of this size, each such unit constituting a kiln which can be operated independently of the others. The ground floor is usually 10 or 11 feet in height, and contains the stoves or heating furnaces, one for each kiln, with space for the storage of fuel. The second floor is usually only sufficiently high at the eaves to permit a man to stand erect, and the ceiling is generally nailed to the lower side of the rafters, this forming an inverted hopper or trough, which has a ventilating tower at its apex. The floor is made of narrow slats laid with an interval of ¼ or ⅜ inch between them, and the fruit to be dried is spread in a uniform layer of 4 to 6 inches in depth upon this floor. For the greater utilization and more uniform distribution of the heat supplied by the furnace, the pipe collar is usually fitted with a T joint, or the furnace may have two openings for pipe, and two lines of pipe are carried around the room one or more times, at a distance of about 2 feet from floor and walls, before passing into the flue.

Such a kiln will require eighteen to 24 hours to dry a charge of sliced apples spread to a depth of 5 or 6 inches. As regards capacity, a

* This article consists of an extract from a bulletin issued by the State College of Washington Agricultural Experiment Station. The prospect of a prolific season with the stoppage of the overseas fruit trade makes the question of the disposal of our surplus apple crop one of great urgency. It is as a suggestion to help to meet this emergency that we are printing this extract. Further extracts from Mr. Caldwell's article will be published in subsequent issues. Perhaps it would be well to invite attention to the article on Apple Drying by Mr. J. Farrell Orchard Supervisor, which was printed in the *Journal of Agriculture* for April, 1916.

20 x 20 kiln is universally called a hundred-bushel drier throughout New York, as it is reckoned that 8 square feet of kiln floor are necessary to dry the slices made from 100 lbs. of apples. The actual daily working capacity for a kiln of this size varies from 100 bushels to 75, or less, by reason of atmospheric conditions, peculiarities in the construction of the building, the varying efficiency of the furnaces employed, or the care employed in spreading and turning the drying fruit.

The Uses and Limitations of the Kiln Evaporator.

The chief use of the kiln evaporator in New York, Pennsylvania, Missouri, and Virginia is for the drying of apples, and many long established plants had never dried anything else until the past winter, during which many evaporators ran at full capacity, drying carrots and cabbage for the use of the European armies.

In the raspberry growing districts of New York, kilns are employed in the evaporation of the surplus crop, the method employed being to cover the kiln floor with burlap or sheeting, to spread the berries in a layer not more than 2 inches deep, and to leave them undisturbed until sufficiently dry to stir without crushing. Loganberries and blackberries can be satisfactorily dried in the same manner. Unpeeled peaches can be treated precisely as apples are, peeled peaches are best handled in the manner suggested for berries. A somewhat more satisfactory product will be obtained in the case of loganberries or raspberries by the use of trays supported by racks placed upon the kiln floor.* Prunes cannot be dried successfully except by the employment of trays.

In a word, if apples are the chief product to be handled by the evaporator, the kiln type of plant is the most economical and efficient type of construction to employ. If prunes, loganberries, and raspberries make up the greater part of the raw material, and apples are a distinctly minor part of it, a tunnel or a Carson-Snyder evaporator should be built. The cost of operation when apples are being exaporated will be slightly greater, but the quality of the product made from berries or prunes will be considerably better.

The Construction of the Building.

While the writer is fully conscious of the importance and necessity of keeping the cost of construction of buildings down to the lowest possible figure, and keenly anxious to prevent unnecessary expenditure, he must strongly advise against the building of such cheap, flimsy sheds of rough lumber as have been suggested by one or two authors. In such buildings there is a very great danger of fire; insurance rates, when insurance can be secured at all, are high; the whole structure deteriorates rapidly, soon becomes an eyesore, in spite of heavy annual repair bills, and must be torn down and replaced after a few years. Successful and economical drying depends upon perfect control of the temperature in the kiln, combined with the greatest possible utilization of the heat

* Inexpensive skeleton racks, each capable of holding one or two tiers of 12 or 16 trays which are placed two or three inches apart to insure good circulation of air, are easily constructed and put in place on the kiln floor, with spaces between them to permit passing to and fro. They should in no case be filled to a depth of more than 1½ inches. As the drying in the lower trays will be much more rapid than in the upper ones, it will be necessary to shift the trays frequently to secure uniform drying. Obviously this method is too laborious to be practical when large quantities of berries or prunes are to be dried, but it is quite possible to work up these fruits into a satisfactory product as a side line in an evaporator whose primary purpose is the drying of apples.

produced. To secure these, one must have a building which is practically air-tight except at air inlets and ventilators, and one from which loss of heat by radiation is, as far as possible, prevented. In an old building full of cracks and knotholes, or a rough structure with walls made of a single layer of corrugated iron or rough boards, one may easily have a constant loss of 25 per cent. of the heat produced by his fuel through radiation from the walls, while the drafts and cross currents of air which sweep through such a structure on a windy, rainy day may practically stop the drying process or permit spoiling of fruit to occur. No one can make money while operating under such conditions. The evaporation of fruits, where undertaken at all, should be undertaken as a definite and permanent part of the yearly programme. To begin it with ramshackle buildings and make-shift equipment is to assume the handicap of high interest rates through rapid depreciation of the investment, large repair bills, which will increase in amount annually, heavy insurance rates, and great risk of fire, a large outlay for fuel which gives low returns in work performed, an increased labour cost, and the occasional loss of a considerable amount of improperly cured product. Some or all of these factors will almost inevitably wreck what would, with the exercise of true and wise economy, have been a successful undertaking. For all these reasons, one must advise that the building housing the kilns be a permanent one as nearly fireproof in construction as possible. The work of preparing the fruit for drying can, in case of necessity, be carried on in any building which can be made into a light, comfortable, sanitary workroom, but the added convenience of having everything beneath one roof and in a building especially designed for the purpose will repay the increased cost.

The materials to be used in building will, of course, depend upon location and local conditions. Building tile makes an ideal building, since the dead air space within the tile materially reduces loss of heat by radiation, but the cost of tile is such as to be prohibitive. Brick will also be too costly in most localities. Where stone is available in the immediate locality, it will be cheaper than any other fireproof material. Concrete or concrete block will cost much less than tile or brick, but perhaps the least expensive method of construction would be to use metal lath and plaster on both inside and outside walls on a wooden frame, with steel girders and metal roof. Old railroad rails, if obtainable, may be used as joists, by the use of wooden strips upon the upper surface to which floors may be nailed. Such a building, if supplied with steel doors, has literally nothing which can be burned except the kiln floors, and if the doors are kept closed, fire cannot spread from the kilns to the workroom.

The cost of construction of a given building will, of course, vary considerably with location, railway facilities, local labour costs, and current prices of materials.

Messrs. Welch and Scott, of North Rose, New York, are operators of a large number of small two-kiln and four-kiln plants, which are models of their kind. The two-kiln evaporator subsequently described fairly represents their plants, except that power machinery has been introduced. These gentlemen have a number of two-kiln plants, 32 x 36 feet in size and 15½ feet to the eaves, each with a paring room 12 x 30 feet, a storage bin 6 x 12 feet, and two kilns each 18 x 20 feet in size. These buildings are constructed of 6 x 8 x 10 inch concrete blocks, and are roofed with

corrugated iron. These plants, fully equipped with three hand power peelers, a hand slicer, a bleacher, and two furnaces for burning hard coal, cost 1,450 dol. each. Similar buildings constructed of wood and lined with asbestos sheathing throughout the furnace rooms, cost 1,250 dol. each. A four-kiln plant built of concrete blocks, with 20 x 20 foot kilns, with power parers, elevator, bleacher, and slicer, cost 2,360 dol. for building and 625 dol. for equipment with power machinery and furnaces, while a wooden building, lined with asbestos, of the same dimensions, and built from the same plans, cost 1,983 dol. for the building. The owner estimated that the additional cost of insurance, painting, and repairs will in seven to ten years make the wooden buildings cost fully as much as the concrete structures, with a rate of depreciation very materially greater.

The plans which follow are the best obtainable after close study of various types of construction. They are intended to serve as suggestions, which may be modified to suit the needs of the individual builder. Thus the two-kiln plant can be readily expanded into a three-kiln plant, that having four kilns into one having five or six. The plans contemplate the use of some source of power for running parers, bleachers, and slicers, but those who prefer to employ hand-power machinery will find some suggestions on a later page, and can easily modify the plans here given to meet their needs. The writer wishes to strongly insist, however, that no more serious mistake than the installation of hand-power machines in his plant could very well be made by any one starting into evaporation as a business. The labour of turning the hand-driven parer is considerable, the women operators become fatigued, and a smaller output per machine of poorly pared, imperfectly cored fruit, requiring more work at the hands of the trimmers, is the result. The task of slicing the fruit with the best hand-driven slicer available is a laborious and time-consuming one. Moreover, the daily transfer by hand of 200 bushels of fruit from paring table to bleacher, and from bleacher to slicer, with a climb to the second floor with each load included, is a task which few able-bodied men will care to continue day after day. A gasoline engine such as is everywhere used for spraying will eliminate this hand labour; the cost of hand and power-driven machines is practically equal, while the saving in wages in two seasons will pay for the shafting, belting, and labour necessary to construct conveyors.

It is assumed that where power is employed, a gasoline engine placed somewhere outside the building will be used. Hence no special provision has been made in any of the plans for an engine placed inside the walls.

Two-kiln Evaporator.

Figures I. to IV. show plans of a two-kiln evaporator with 18 x 20 foot kilns, having an average daily capacity of 175 bushels fresh fruit or a seasonal capacity for a 60-day evaporating season of approximately 10,000 bushels if no peels and cores are dried. Since this amount of apples, at least, will be available in ordinary seasons in any locality where the construction of a commercial evaporator is being seriously considered, plans for smaller plants are not included here. Those desiring suggestions as to the building of a one-kiln plant will find plans and suggestions for their construction in *Farmers' Bulletins* 213 and 291.*

* Issued by the State College of Washington Agricultural Experiment Station.

It must be emphasized, however, that the operation of a one-kiln plant, under conditions prevailing in Washington, can scarcely be commercially profitable, while the two-kiln plant will yield a comparatively narrow margin of profit if any considerable portion of the labour employed must be paid for at current rates.*

In the following description, details as to construction of a number of essential parts of the equipment, for example, paring tables, apple and waste conveyors, &c., are omitted. These are fully described and figured in the section on "Model Four-kiln Evaporator." The construction and arrangement are essentially the same in the two cases.

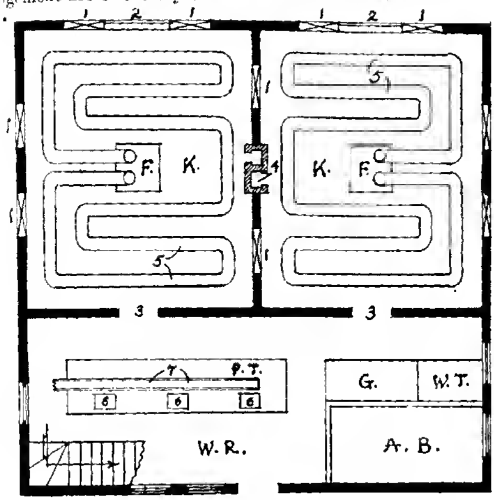


Fig. I.—Two-kiln Evaporator, Ground Floor Plan.

K, kilns, each 18 x 20 feet. W.R., work room. 12 x 36 feet. A.B., apple bin. W.T., washing tank. G., grader. P.T., paring table F., furnace 1. 1, ventilators, 3 x 1½ feet. 2, fuel doors of kilns. 3. doors from work room. 4, chimney of furnaces. 5, piping of furnace. 6. parers. 7. apple conveyor on paring table.

The building shown in the plans is 36 x 32 feet in size, and 16½ feet in height at the eaves. The first story is 10 feet in height to the floor, and is divided into two furnace rooms, each 18 x 20, and a paring room, 12 x 36 feet. The furnace rooms have considerable space available for the storage of fuel. The furnace, arrangement of piping, &c., is subsequently discussed in detail under the head "Heating Apparatus." The most important feature of the constructtion of the furnace room is that adequate provision for inlet of air be made. The plans here given

* The following note is supplied by Mr. J. Farrell, Orchard Supervisor, Victorian Department of Agriculture:—It is suggested that small capacity evaporators might be profitably employed in orchards in districts where wood fuel is plentiful, and where such evaporators could be worked by orchardists and their families.

provide two air inlets on each side of every kiln, each 3 x 1½ feet, placed 6 feet apart, and at a distance of 6 inches above the floor of the kiln. When kilns stand in series, the wall between adjacent kilns has these openings just as do the outside walls, and upon the side on which the paring room adjoins the kilns, openings in the outer wall lead beneath the paring room floor to the openings in the kiln. Such an arrangement secures perfect control of the air movement irrespective of direction of wind. Sliding iron doors running in grooves permit opening or closing of the air inlets to any desired degree.

Each of the furnace rooms should have a sheet iron door opening to the outside, in order to permit the unloading of fuel directly into the kiln. This door may be centrally placed in the outer wall, as indicated

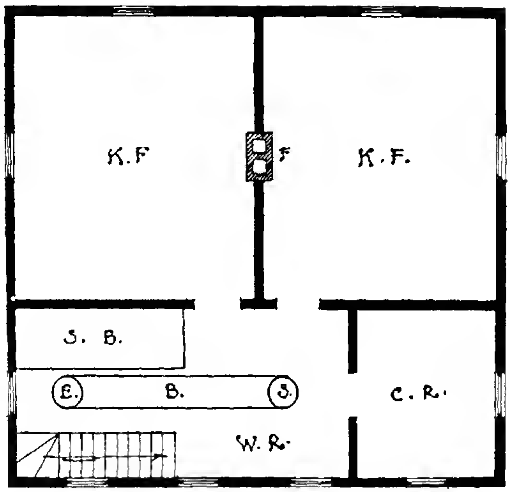


Fig. II.—Two-kiln Evaporator, Second Floor Plan.

K.F., kiln floors. W.R., work room. C.R., curing room. S.B., storage bin. E., elevator. B., bleacher. S., slicer. F., chimney of furnaces.

in the plans, and need not be more than 5 feet high. It should be 4 feet in width to facilitate easy handling of wood. Most important of all, it should be fitted with a good substantial lock, and the key should be in the possession of the furnace man, in order that careless or irresponsible people may not stop the drying process by leaving the door open.

The floor of the paring room should be of a good quality of matched flooring, and should be carefully laid, in order to facilitate cleaning. It should be elevated sufficiently above the ground to permit free passage of air from the inlets in the outer wall to those in the walls of the kilns, as shown in the plans of side elevation of the four-kiln evaporator. One end of the paring room is occupied by a storage bin, 12 x 6 feet, which may be given a capacity of 575 bushels by carrying its walls up to the

ceiling. The storage bin is filled from outside. As apples are used, they are drawn through a sliding door directly into a washing tank. If no power equipment is available, one man washes off adhering dirt, throws out over-ripe and rotten apples, runs the washed apples through the grader, if it be desired to separate the fruit into several sizes prior to peeling, keeps the peelers supplied with apples, and removes peelings as they accumulate. One man can easily do this while attending to the fires in the kilns, if the arrangement suggested is followed. If power is available, a belt conveyor which carries the washed apples to a bin on the second floor, from which a system of chutes distribute them to the parers as needed, should be installed. This arrangement, which is fully described on a later page, enables one man to prepare enough apples for a day's run in a little more than an hour, leaving the remainder of the day free for other work.

The paring table should be constructed as described on page 49. It is lighted by two large windows, and the parers sit beside these windows, with the light falling over their shoulders. The peeled fruit rolls across the table from the peelers to the trimmers, who sit opposite. The trimmers remove bits of parings, bruised spots, and other imperfections, and throw the trimmed fruit on an endless belt conveyor, shown in the centre of the paring table and fully described in a later section, which carries the fruit into the elevator, and thus to the bleacher. In the absence of a source of power, the trimmed fruit must be dropped into boxes which are carried to the bleacher by hand as they become filled. In no case should fruit be allowed to lie any length of time after peeling before placing in the bleacher, or darkening will certainly occur.

Several types of bleachers are in use, and the next step in the process will depend upon the particular type employed. The type which is most widely used consists of a long, tight box, 18 inches to 2 feet in width, and with a length of 6 to 10 feet per 100 bushels of daily capacity, or 24 to 40 feet for a four-kiln plant. The apples are carried by the conveyor into one end of the bleaching box, and fall upon an endless slat and chain belt, which extends the length of the bleacher. By means of a worm gear, this belt is made to move very slowly, so that 30 to 40 minutes are required for fruit to pass through the box and drop at the opposite end into a storage bin, or directly into the hopper of the slicer. Sulphur is burned in a heavy iron pot, or other suitable vessel, placed just outside and below the apple inlet, and at the opposite end a small pipe conveys the fumes into the flue. Heavy leather or weighted canvas flaps close the inlet and outlet for apples, to prevent the escape of fumes into the room. Such bleachers are sold complete by a number of firms, but it is a matter of economy to purchase only the metal parts, since an intelligent carpenter can construct the box and set the machine up ready to run with the aid of the diagram, Fig. III.

In case the plant does not have a source of power, another type of bleacher must be employed. One very common type consists simply of a long box, high and wide enough to receive an ordinary apple box, and sufficiently long to accommodate six to ten such boxes placed end to end. Tightly fitting doors are provided at the ends, and a track along which boxes may slide is made by spiking two 2 x 4 scantlings on edge to the floor of the box. Sulphur is burned in a pan placed between the tracks

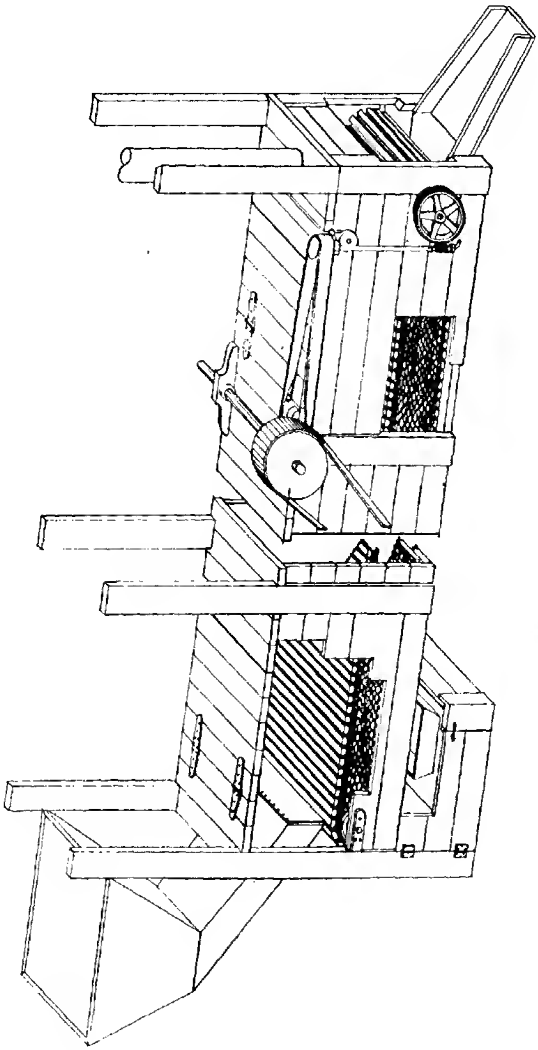


Fig. III.—Power Bleacher.

at one end, and the fumes are carried off by a pipe at the opposite end. As apples are pared, they are placed in boxes, and as a box becomes filled it is pushed in at one end of the bleacher, moving those already there onward toward the opposite end, where they are withdrawn when sufficiently bleached.

Another satisfactory bleacher consists essentially of a bureau-like structure carrying a series of shallow, tight-fitting trays or drawers, whose bottoms are made of narrow slats or boards in which numerous ½-inch auger holes have been bored. Sulphur is burned in a tight compartment below the lowermost drawer, the fumes rise from tray to tray through the fruit, and are drawn off by a small pipe at the conical top. A bleacher of this type should be made of such a size that each tray will carry a box of pared apples spread in a layer two apples deep. While such a bleacher does very effective work, it must be emphasized that the additional time and labour required in repeatedly handling the fruit is very considerable, and that power installation is always strongly advised as a matter of economy.

Whatever the type of bleacher employed, it cannot be too strongly emphasized that the piping must be carefully done in order that the fumes may not escape into the room. They are intensely irritating to the eyes and throat, and they attack metal so vigorously that when allowed to escape at the level of a shingle roof, the nails may be absolutely destroyed in the course of two or three seasons. Therefore, terra-cotta pipe, carefully cemented at the joints, or heavy cast iron pipe (called by plumbers soil pipe), with the joints set in white lead, should be used, and it should be connected with one of the kiln flues in order to carry the fumes well above the roof. If iron pipe is used, its term of service will be materially increased by flowing white lead paint repeatedly through it, at intervals of a few hours, so that the inner surface gets a good heavy coating.

When taken from the bleacher, the fruit should be sliced at once. There are several hand-operated slicers on the market, but the work with the best of them is slow and laborious, and requires the time of two men. A power slicer costs very little more, does more and better work in a given time, is automatic in action if a power bleacher delivering into the hopper of the slicer is used, and requires one man only if there is no power bleacher, and apples must be fed from barrels or boxes. Consequently a power slicer will save its cost in labour in two seasons.

From the slicer the apple rings fall into boxes or barrels standing on trucks, and are transferred to the kiln floor. Here they are spread as uniformly as possible, usually by means of a wooden rake, to a depth of 4 to 6 inches, and are left undisturbed until drying at the surface has made the slices tough enough to permit stirring without injury, which usually requires four or five hours. They are then thoroughly stirred by means of wooden rakes and shovels. This stirring is repeated, at first at intervals of two hours, then more frequently, until the fruit receives three or four thorough stirrings in its last two hours on the kiln floor.

When dry, the fruit is transferred from the kiln floor to the storing or curing room, where it is piled up to a depth of a foot or more, to undergo a slow after-curing process prior to being packed.

The roof of the building is so constructed that the apex or ridgepole is directly over the middle of the row of kilns, which are ceiled directly on the rafters with metal or boards. The ventilating shaft occupies the apex of the roof, extends the entire length of the building, and should be 3 feet in width and at least 4 feet in height. A rather widely used type of ventilator is shown in Figure IV. Its distinctive feature is the fact that it is double-walled, the outer walls having no connexion with the inner, and being placed at a distance of 12 to 16 inches from them. These outer walls are not covered by the roof of the ventilator, but are boarded solidly except for a space of 12 inches in width at the

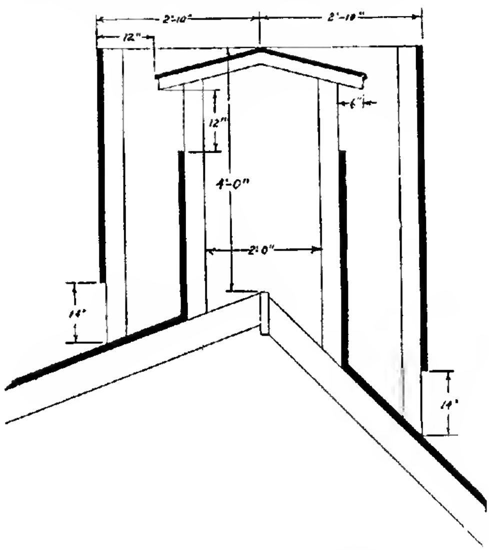


Fig. IV.—Details of construction of double-walled ventilator. Warm air escapes from the shaft through the continuous opening 12 inches in width at the top of the inner wall; the opening at the bottom of the outer wall permits cold air to enter and pass up between the walls, assisting the draught, while the upper portion of the outer wall keeps snow or rain from blowing into the shaft.

bottom, which is left open for the entire length. The inner walls are boarded up solidly from the bottom for a distance of 3 feet, leaving a space a foot in width just beneath the ventilator roof, through which the warm air escapes from the kilns. The outer wall thus has an opening at the bottom through which currents of cold air moving along the roof of the building may enter the space between the walls, passing up between them and assisting in carrying off the warm moist air escaping at the top of the shaft. The outer wall makes it impossible for the wind to blow directly into the opening in the inner wall, which would interfere with the escape of the warm air, and also keeps rain or snow from

driving into the shaft. While such ventilators are said to work well, the fact that they cannot be opened and closed with varying atmospheric conditions make them less efficient than a second type, in which the side walls of the ventilator are made in sections exactly like the ordinary window shutter, the boards of which the shutters are built being 3 or 4 inches wide. By means of ropes attached to the shutters, and passing over pulleys, the individual shutter can be opened or closed at will. Such an arrangement permits perfect control of the draught, without which it is impossible to secure uniform results.

Model Four-kiln Evaporator.

Figures V. to X. give plans for an evaporator having four 20 x 20 foot kilns with an approximate capacity of 400 bushels of apples per day. Many features of the construction and equipment are essentially identical with those of the two-kiln plant just described, and will be clear without further explanation.

In a plant of this or larger size it would be a fundamental and well nigh ruinous mistake to install anything else than a complete outfit of

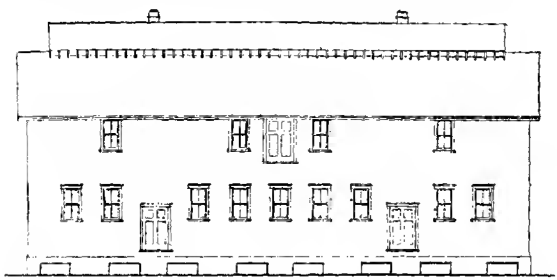


Fig. V.—Side elevation, four-kiln evaporator. Note particularly the ventilating openings in the wall, which permit free entrance of air beneath the floor of the work-room to the air inlets in the walls of the kilns.

power machinery. With power-driven parers, five girls or women will prepare at least as much fruit as six women using hand peelers, without the fatigue, and consequent careless and imperfect work which occurs when machines are run by hand. With conveyor, bleacher, and slicer driven by power, one man can look after the furnaces and keep the peelers' table supplied with apples and clear of refuse, while a second man can take care of the fruit at the slicer and on the kilns. Were the fruit to be moved and sliced by hand, two additional men, or a man and a strong boy would be needed. Consequently, complete power equipment easily saves the wages of two or three hands in a plant of this size, and will pay for itself in three or four seasons.

In the plan here given, the apples are delivered from the waggons to the storage bin, which is 12 x 15 feet in size. If it is desired to keep varieties separate, which is highly advisable, this bin may be divided into two or more compartments, in which case both the outer receiving door and the door to the discharging chute would be built in sections

opening separately for each bin. From the bins, sliding doors open into a discharging chute, through which the apples are run directly into a washing tank. From this point there are two possibilities. One man may wash the apples, transfer them into the grader, if it is desired to work up large and small apples separately, and carry the fruit from the grader to the tables, or a conveyor may be rigged to carry the apples

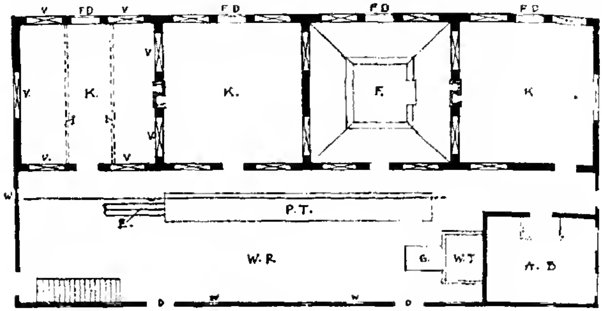


Fig. VI.—Four-kiln Evaporator, Ground Floor Plan.

K.K., kilns, each 20 x 20 feet. W.R., work room, 80 x 18 feet. A.B., apple bin, 12 x 16 feet. W.T., washing tank. G., grader. P.T., paring table. E., conveyors for apples and waste. V., ventilators, 5 x 1½ feet. F.D., fuel doors to kilns. I., I-beams supporting kiln floors. F., furnace with jacket-and-hopper construction. W., windows. D., doors.

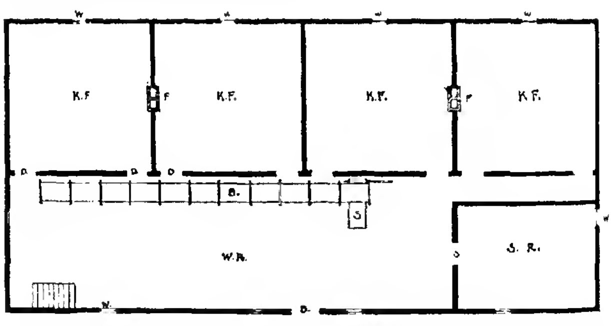


Fig. VII.—Four-kiln Evaporator, Second Story Plan.

K.F., kiln floors. F., flues from furnaces. W.R., work room. S.R., storage bin. B., bleacher. S., slicer. D., doors. W., windows.

from the washing tank to the hopper of the grader, while a second conveyor, placed closely against the wall out of the way, receives the fruit and carries it to a conveniently located bin on the second floor. From this bin a series of chutes pass through the floor and descend to the paring table, each ending in a sliding door, which opens into a box placed beside the parer. With this arrangement, one man can, in a

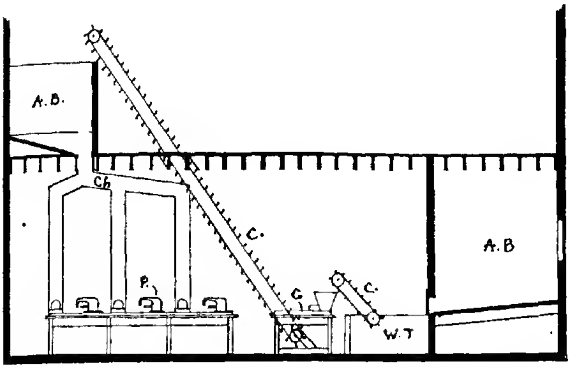


Fig. VIII.—Sectional View of Evaporator from Side, showing Belt Conveyor from Grader to Storage Bin and Chutes from Bin to Paring Table.

A.B., apple bin with elevated floor and sliding door delivering into W.T., washing tank. C., conveyor lifting apples from washing tank into a hopper of G., grader, C., a second conveyor receiving apples from grader and carrying them to A.B., apple bin on second floor. Ch., chutes from second-floor bin to paring table. P., parers.

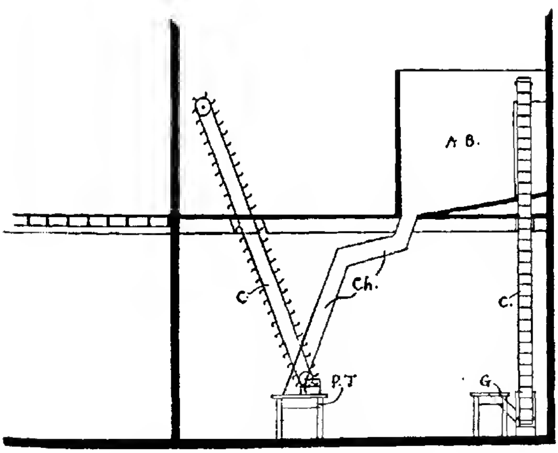


Fig. IX.—Sectional End View of Evaporator

showing G., grader; C., conveyor; A.B., apple bin with floor inclined to mouth of Ch., chute, to P.T., paring table; C., conveyor from paring table to bleacher.

couple of hours, wash and grade enough apples for a day's run, and is then free for other work. Since the floor of the bin has a slight inclination toward the chute, the apples pass by gravity from the bin into the chutes, keeping them filled so long as there are apples in the bin, and the parers have only to open the sliding doors for a moment to fill their apple boxes as these become empty. This arrangement is not shown in the floor plans, since it would make the drawings rather complicated, but it is diagrammatically represented in Figures VIII. and IX. The small apples are collected from the grader into boxes or barrels, and are worked up separately when a sufficient quantity has been collected.

The shafting which drives parers, conveyors, and grader is suspended from the joists, and 12 inches below them, so as not to interfere with

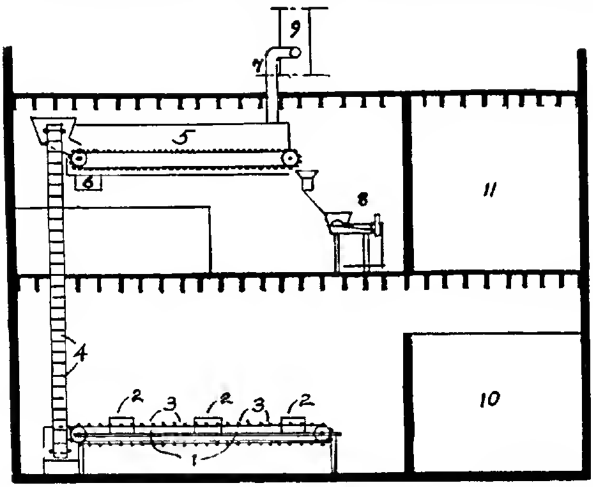
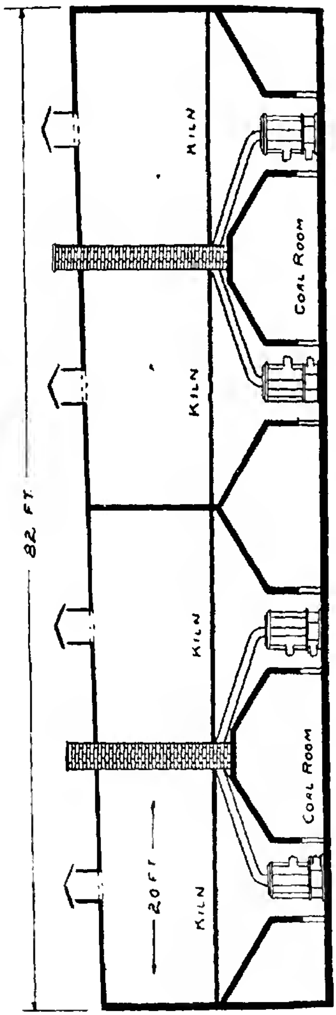


Fig. X.—Sectional View of Plant, showing Arrangement of Conveyors.

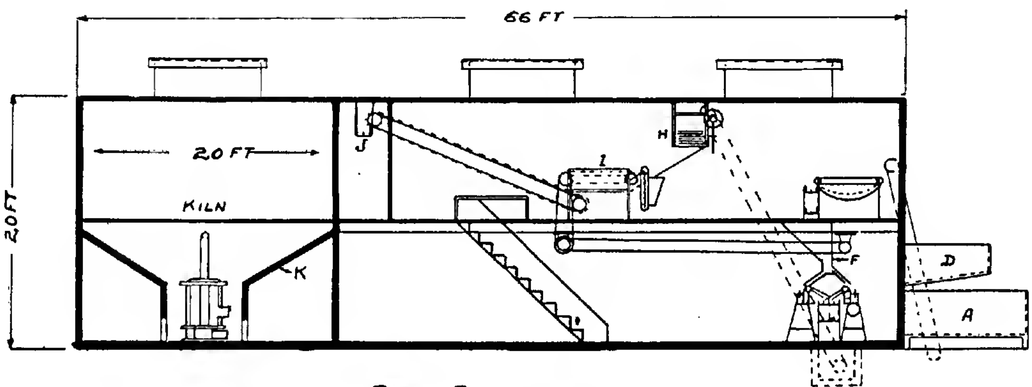
1, paring table. 2, position of paring machines. 3, endless belt conveyor for pared apples. 4, elevator from end of paring table to hopper of 5, bleacher. 6, sulphur chamber of bleacher. 7, pipe of bleacher, opening into 9, flue of furnace. 8, slicer. 10, storage bin. 11, kiln.

free movement around the work table. The apple waste conveyor is six inches wide, and runs in the bottom of a trough 7 inches wide and 4 inches deep, raised 6 inches above the top of the table, as shown in Figure X. This elevation of the apple conveyor above the table has two advantages, the peels and cores do not fall into it, as would be the case if it ran at the level of the table, also, apples upon it are visible from any part of the room, and it is impossible for a trimmer to do careless work without being detected. The top of the table is slightly inclined—a drop of 1 inch in $3\frac{1}{2}$ feet is sufficient—toward the side at which the trimmers sit, which is faced with a 1 x 2 strip projecting $\frac{3}{4}$ inch above the edge. The pared apples drop from the forks of the machines and roll down the slight incline, beneath the conveyor, to the



SIDE ELEVATION

Fig. XI.—Sectional Side Elevation of Eight-kiln Evaporator.



FRONT ELEVATION

Fig. XII.—Front Elevation of Eight-kiln Evaporator.

A., bin for apples outside building, with conveyor carrying apples to grader on second floor. D., bin for small, or cider, apples removed by grader. E., conveyor to hoppers, F., beneath floor of second story, from which chutes deliver them to the peelers, as shown in Figures VIII. and IX., H., bleacher. I., slicer, which has conveyor carrying apples into the conveyor, J., which delivers them to any desired kiln door.

opposite side, where they are arrested by the edging strip. When trimmed, a mere turn of the trimmers' hand deposits the apple on the conveyor. The conveyor for waste is placed below the table, beneath and slightly to the inner side of the paring machines, and an opening 8 inches square just back of each machine permits peels and cores to drop directly upon the belt, while the waste from the trimmers' side of the table is easily swept into the openings as it accumulates.

The work table shown in the plans has ample space for seven machines and for fourteen trimmers. With power parers kept in a good state of repair, six experienced peelers should, in a nine-hour day, easily pare enough fruit to keep a 400-bushel plant going. The number of trimmers needed will depend upon the mechanical perfection and state of repair of

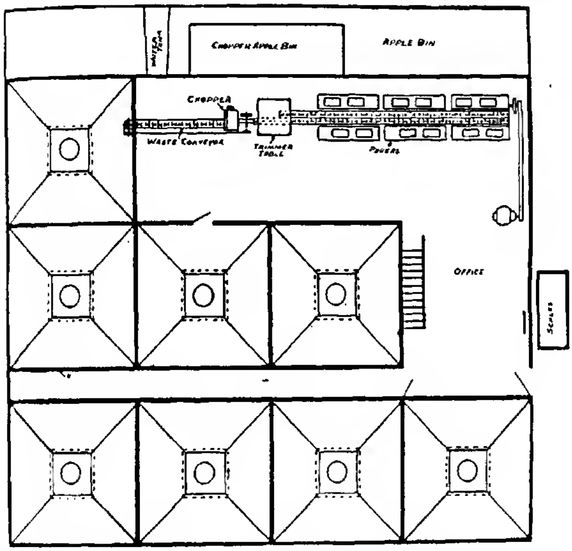


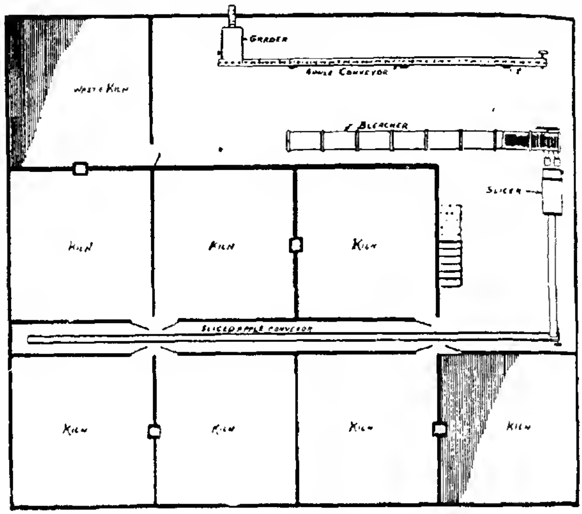
Fig. XIII.—First-floor Plan, Eight-kiln Evaporator.

Paring table arranged for double row of paring machines, with trimmers at a separate table.

the parers, and to an even greater degree upon the character of the fruit. When working with good C grade fruit, three experienced trimmers may easily keep the tables clear for two machines, while with small culls, or fruit having decayed spots or much codlin moth injury, two trimmers to each parer may find it difficult to properly trim the fruit. In any case, economy at the trimming table means fruit of poor quality, which will find a market at less than prevailing prices for "prime" fruit.

The conveyor from the work table delivers the fruit to the bleacher, which is supended from the joists, 6½ feet from the floor, out of the way of those working in the rooms. The bleacher delivers the apples into a bin placed at such a height above the floor that they may be brought to

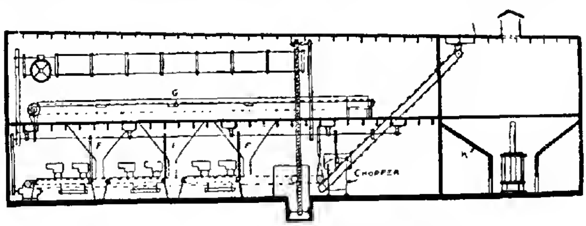
the slicer by gravity, or they may pass directly into the hopper of the slicer when it is in operation. From the slicer the fruit may be received in a barrel standing on a truck and pushed into the kiln by hand, or it



Second Floor Plan.

Fig. XIV.—Second-floor Plan, Eight-kiln Evaporator.

Grader has apple conveyor running longitudinally over paring table, and opening at points marked F into hoppers which deliver apples by gravity to the paring table. Bleacher delivers apples to slicer, from which a conveyor carries them down the alley between kilns, delivering them at any desired point.



Side Elevation

Fig. XV.—Sectional Side Elevation, Eight-kiln Evaporator.

K., kiln with jacket-and-hopper construction. Paring table has endless belt conveyor to trimming table, from which the elevator delivers to bleacher. Endless belt from grader delivers apples to hoppers F., over paring tables, through openings marked G.

is quite possible to construct a simple system of belt conveyors, which will receive the fruit at the slicer and convey it to a point inside the door of the kiln which is being filled.

In the plan here given, the conveyors from the work table deliver both apples and waste upstairs. In case peels and cores are to be discarded or used for stock feed without being pressed for vinegar, the plan can easily be modified by extending the waste conveyor so that it delivers at any desired point outside the building.

Plants of Larger Capacity.

Figures XI. to XV. present plans of a model eight-kiln plant, having an approximate daily capacity of 800 bushels, or a total capacity of 40,000 to 48,000 bushels for a season of 50 to 60 days. Only the exceptional individual or community will have need for a plant of such capacity, and the plans are purposely generalized in order that they may be easily modified to make them suit individual needs. It may be pointed out that the building is as compact as it is possible to make it, hence cost of construction will be minimum, and that labour-saving machinery driven by power replaces hand labour wherever possible. The eight kilns are so arranged that free movement of air into each of them from any point of the compass is possible, which is not the case when kilns are arranged side by side in a long row of six or eight. The full explanations accompanying the drawings, with the descriptions of smaller plants which precede, make detailed description unnecessary.

(*To be continued.*)

Since the introduction of pure cultures of nodule bacteria for soil inoculation by Nobbe and Hiltner in 1895, a vast number of field experiments has been carried out in different countries and with a great variety of inoculating material.

The results of such experimental work were in the first instance most discouraging, and it is only within the last few years that the conditions determining success or failure have been adequately recognised. During this time the relations existing between the host plant and the nodule organism and between the organism and artificial media used for cultivation in the laboratory have been studied in detail, and in the light of these investigations it is not surprising that failure attended much of the preliminary and often haphazard field work. Experience has shown that it is not sufficient to have a pure and active culture in order to attain success in soil inoculation, but that the soil itself shall be suitable for the growth and continued existence of the introduced organism, and that the supply of mineral nutrients shall not be the limiting factor in the growth of the plant. Liming has been required in many cases, and with a proper recognition of the now known essential conditions, the number of successful cases of inoculation trials has steadily increased during recent years.

Comparative work with pure cultures and inoculation by means of soil which has previously carried a specified leguminous crop have shown in the majority of cases the superiority of the latter, and cultivation in the laboratory has latterly included the use of soil media or soil itself, since the organism appears to retain its power of infection to a greater extent in this than in other media.

SPRING GRAFTING OF THE VINE.

By F. de Castella, Government Viticulturist.

(Continued from Page 565.)

If, when grafted, the stock is of such a size that scions equal to it in diameter are obtainable, several courses are open.

The ordinary cleft graft, described in last issue, may still be practised. In this special case, the cambium sections of stock and scion can be made to meet at the back as well as at the front of the graft, a very neat union resulting, almost equal in fact to that obtained with the whip-tongue graft. Should the scion happen to be slightly larger than the stock, knitting at front and back can still be obtained by trimming the scion in such a way that the apex of the wedge forms the diameter of the cane; in other words, the apex should be through the pith and not to one side of it. The trimmed scion can then be squeezed "fore and aft," the pith yielding sufficiently to allow the cambium sections to be completely brought in contact.

In addition the grafter has the option of three other grafts, namely, the "mitre" or "aglet," Champin's and the whip-tongue grafts. The first two are described in *American Vines* by Viala and Ravaz, and in *The Manual of Modern Viticulture* by G. Foex (obtainable from this Department).* Though capable of giving good unions, they are inferior to the whip-tongue graft, which is the only one of the three we need here consider in detail.

The Whip-Tongue Graft.

This is certainly the best of all grafts. It is, in fact, the only theoretically perfect one. The cambiums meet at every point of the cut surfaces, with the result that in the case of stout stemmed stocks it is often impossible, after a few years, to discern the point of union. Horticulturists, and particularly apple growers, have long been familiar with this graft, but, as applied to the vine, and especially of recent years, it has undergone such considerable modifications that they would scarcely recognise it as now executed in the State Vine Nursery at Wahgunyah as the same graft they practice. The main difference lies in both stock and scion being cut to a much shorter bevel. This shortness has, indeed, been considerably accentuated of recent years, with excellent results, as will be shown presently.

The older type of whip-tongue graft, as applied to the vine, will be readily understood on reference to Fig. 6. Stock and scion are prepared in exactly similar manner; both are cut to the same bevel by a single movement of the grafting knife. This bevel is at a somewhat variable angle, but usually between 15° and 25°, according to different authorities.†

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* *American Vines: their adaptation, culture, grafting and propagation*; by P. Viala and L. Ravaz. English translation by Dubois and Wilkinson (1901). Post free, 1s. 1½d.

Manual of Modern Viticulture: Reconstitution with American Vines; by G. Foëx English translation by Dubois and Wilkinson (1902). Post free, 10d.

These two standard works by leading French authorities contain much valuable information concerning vine grafting.

† According to Foëx, 16° to 18°.

According to Pacottet, 14° for small canes, and 17° for larger canes. Bioletti (Bulletin No. 180, University of California, 1906) states that "the length of cut surface should be from three to four times the diameter of cutting, the shorter cut for the larger sizes and the longer for the thinner. This will correspond to an angle of from 14·5° to 19·5°..

On both stock and scion a cleft is made which serves to separate a small tongue of wood. This cleft is made in exactly similar manner on both stock and scion; it commences at about the upper third of the bevel (towards the point), and extends, following the fibres of the wood, to the lower third. This will be readily understood from Fig. 6. In order to bring about the complete fit here shown, it is necessary to bind the graft. Without it there is apt to be a gap between the points of stock and scion and the cut surfaces on which they are to lie, which may result in these points drying out; the longer the bevel, the greater the danger of this occurring.

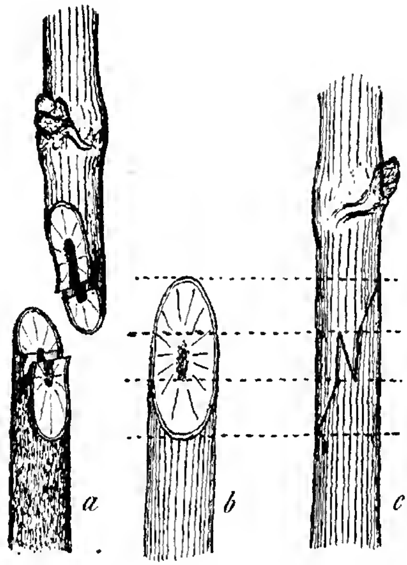

Fig. 6.—The Whip Tongue Graft. Old style.

The tongue is formed by a cleft, following the grain of the wood, commencing at the upper third of the stock and penetrating to the lower third. The scion is prepared in an exactly similar manner.

a. General sketch of graft.
b. Method of cutting stock.
c. Completed graft.

Most French authors recommend cutting the cleft with the grain of the wood. Bioletti, however, recommends an oblique cut—

The tongues are made with a slow, sliding motion of the knife. They are commenced slightly above one-third of the distance from the sharp end of the bevel, and cut down until the tongue is just a trifle more than one-third the length of the cut surface. The tongue should be cut, not split. The knife

should not follow the grain of the wood, but should be slanted in such a way that the tongue will be about one-half as thick as it would be if made by splitting. Before withdrawing the knife, it is bent over in order to open out the tongue. This very much facilitates the placing together of stock and scion.

Such was the older whip-tongue graft. Within the last ten years it has undergone considerable modification, mainly in the direction of a much shorter bevel, a change which constitutes a very considerable improvement for bench grafting, and which can also be applied when the whip-tongue graft is practised in the field. The main object of the change was the suppression of the tie, necessary in connexion with the older form, thus permitting a saving of time, and ensuring more thorough callusing, and therefore a more perfect union. The improved method was described somewhat fully by M. L. Lebrun†, from whose article the following extract has been translated.

After pointing out that the older type of whip-tongue graft is easily disjointed unless solidly tied; that during the operation of tying a certain amount of displacement, detrimental to success, often occurs; and that the binding substances in general use are far from perfect, he proceeds to describe how M. Charmont, Sen., of the nursery firm of Charmont and Sons, of Saint-Clement-Les-Mâcon, at a meeting of the Horticultural Society of Saone et Loire, held in 1885, pointed out the drawbacks of tying, and suggested the desirability of obtaining a more solid graft by means of stouter tongues and deeper clefts. Shortly afterwards one of his workmen evolved the wished-for graft, which immediately came into general use. Stocks and scions are selected and prepared in the same way as previously; it is the graft only that differs. M. Lebrun describes this as follows:—

"To prepare a tie-less graft, all that is necessary is to modify the sections and the clefts of the ordinary whip-tongue graft. A clean, straight, absolutely plain section is made with a single movement of the grafting knife. The bevel thus made is at an angle of about 38°, and the length of the section is scarcely double its breadth. Thus is obtained a shorter bevel, at a less acute angle than for the ordinary graft, but the most noticeable difference is to be found in the mode of making the cleft. Instead of applying the knife blade at the upper third of the section (Fig. 7), it is almost at the top of the bevel that the cut must be started. Further, the cut must not be made to follow the fibres of the wood, or be approximately parallel to the axis of the cane, but it must be made obliquely, following a direction practically parallel with the bisectrix of the bevel angle. A cleft is thus made about one centimetre (.39 inch) deep, the chief merit of which is to provide a stout tongue. Fig. 7 shows where and how the grafting knife should be applied and directed. . . . .

"Stock and scion are prepared in exactly similar manner. Although experiments by different nurserymen prove that, whether the section be started just below an eye or on the opposite side, has no influence on knitting, the cut should be started on the bud side; a more solid graft results, and the grafter is better able to examine the condition of the bud . . . . The fitting together of stock and scion is quite easily effected, the tongues being pressed home into the clefts made to receive them.

"The new departure is certainly more favourable to knitting; drying out of the points of the bevels is much less to be feared, and the depth of the clefts multiplies the points of contact (of cambium sections) which are more numerous than with the old style. Furthermore, the absence of the tie increases the chance of success. Binding prevented the grafts from decapitation in handling, but want of care in binding often disunited cambiums carefully fitted together by the grafter, and was often the sole cause of bad unions and failures. . . . . The new graft permits dispensing with useless manipulations, which were not without disadvantages; it has rapidly conquered all workshops (for bench grafting) and the tie, which has caused so much worry, and given rise to so much discussion, will soon be completely forgotten."

† La greffe sans ligature (The tie-less graft) by M. L. Lebrun, Professeur departemental d'agriculture de Saône et Loire.—Progrès agricole, 17th April 1910.

This prophecy was fulfilled, and the tie-less graft is now in general use in all large vine nurseries. When grafting in the field, the whip-tongue grafts may with advantage be applied whenever stock and scion are of the same diameter. It gives the perfection of union characteristic of bench grafts executed in this way. Only in connexion with one point is care necessary; the very perfection of the fit is a source of danger if the sap pressure of the stock be such that profuse bleeding occurs when it is cut. There is obviously less get-away for surplus

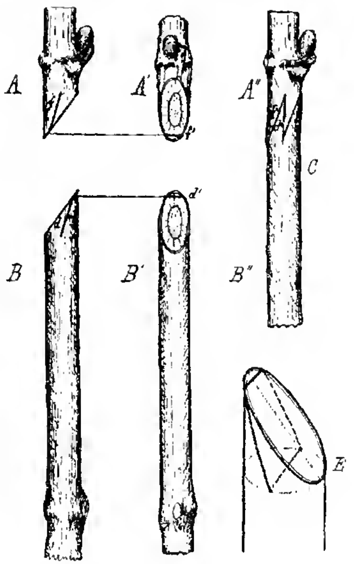

Fig. 7.—The Improved Whip Tongue Graft. (After Lebrun.)

Note the much shorter bevels and the deep oblique clefts, which commence near the apex of the bevel. A, A^1, scion; B, B^1, stock; A^{11}, stock and scion fitted together. E, diagram showing how the oblique cleft is made.

sap than in the case of the ordinary cleft graft, hence preliminary cutting back of the stock a few days before grafting (see *Journal* for September, page 557) is even more necessary.

Subsequent Care of Graft.

Should weather conditions, after grafting, happen to be all that could be desired, knitting is rapid, and the shoots of the scion soon make their appearance through the top of the mound. Every precaution must be taken to protect the young growth from depredations of cut-worms (Agrotis caterpillars) and of several beetles which are nearly as troublesome. These pests are best combated by arsenical poisoning in the

shape of lead arsenate spray, if the worms be small, or baits if they be large; a good formula for the latter is as follows:—Bran, 10 lbs.; molasses, 4 lbs.; Paris Green, 4 ozs.* Careful attention to these pests cannot be too forcibly urged. Neglect of the usual precautions is, in fact, a fruitful cause of failure in the establishment of a young grafted vineyard.

The tie will also often require attention, especially if binder twine or other stout string has been used. If too stout, or if the soil has been too dry for it to rot, the mound must be carefully broken down, the tie cut through with a sharp knife, and the mound reformed. The best moment for doing this work cannot be fixed exactly; it depends on the amount of growth made by the scion. What must be especially avoided is too much constriction of the rapidly expanding new stem. If bound with thinner twine or raffia, and moisture conditions be suitable, the tie usually rots, rendering cutting unnecessary. Examination of a few vines will show what course should be followed.

As soon as they are sufficiently long the young shoots must be tied to the temporary stake. They may be tied to the wire if, as is sometimes done, the vineyard has been trellised thus early. In either case tying must be executed fairly loosely, so as not to unduly constrict the young canes. If tied to wire, make a clove hitch round this with the twine, take a loose loop of same round the shoot, and fix to the wire again with a further clove hitch.

Some authorities recommend stopping the terminal bud of each cane (if there are more than one) at a height of about 30 inches from the ground. Some of the lateral growths thus forced out may be employed at the following winter pruning for forming the permanent frame-work of the vine.

It frequently happens that weather conditions are not altogether favourable, in which case things do not happen exactly as outlined above. A very wet spring, during which the vineyard is practically flooded by continual rain for a month or so after grafting, may cause more or less complete failure. Without being so altogether unsuitable as this, the season may be cold and the scion may be slow in making a start, the poor progress made by the grafts being such as to raise doubts as to their ultimate success. Even so, a good percentage of takes is often obtained, but care and a good deal of extra work will be rendered necessary, more particularly in connexion with

The Removal of Suckers.

Needless to say, any growth taking place in the shape of suckers is at the expense of the scion. Grafts which knit rapidly, and commence growth early, usually throw few suckers. It is those which remain dormant for some time which give most trouble. Some stocks are also much more liable to suckering than others—Rupestris du Lot, for example. Suckers must be removed with great care as the knitting tissues are still tender, and the scions easily disturbed, with fatal results.

* See Journal of the Department of Agriculture for July, 1911. A reprint of the article on cut-worms is obtainable on application to the Department.

Novices who endeavour to merely pull them out from above are sometimes disappointed at finding that the scion has come away with a bunch of suckers. Sahut recommends to first cut the suckers as far below the ground as possible with a long, thin-bladed knife, in much the same way that one cuts asparagus. They thus receive a temporary check, which helps the knitting of the scion. A little later on the mound should be broken down, and the suckers cut off flush with the stock with a sharp knife, the mound being made up again, but to a lesser height than formerly. In seasons that are not altogether suitable for grafting, removal of suckers often entails a considerable amount of work, the grafts requiring attention not once, but several times, during the first season.

Scion Roots.

Mounded up, as it must be, to insure knitting, the scion is placed under conditions suitable for it to send out roots of its own, and unless the spring be an unusually dry one, these must always be reckoned with. Their careful removal is imperative. Neglect of this is a fruitful cause of failure of vines grafted on resistant stocks. Suckers are bad enough, but scion roots are even worse. Suckers are an eyesore, which no careful vine-grower can tolerate, but scion roots are below ground, and hidden from view. "What the eye does not see the heart does not grieve."

The young graft opposes a slight, but nevertheless real, obstacle to the free flow of sap. The scion roots, if allowed to grow, receive more elaborated sap than those of the stock, which cease to develop, and become stunted, even if they do not die away altogether. This is clearly shown in figure 8. The scion then depends entirely on its own roots, which are, of course, incapable of resisting phylloxera. The objects of grafting are thus nullified, and the vine ultimately succumbs, the stunted resistant roots being quite incapable of responding to the call suddenly made on them when the scion roots are destroyed by the insect. To quote Bioletti—

> "If the scion is allowed to make its own roots, the return stream of nutritive material takes the course of least resistance, and goes principally into the scion roots. The result is that these grow vigorously, so long as phylloxera is absent, and the roots of the resistant stock are starved, and finally die. This is not mere theory, but is substantiated by the numerous cases where dying resistant vineyards have been examined, and this condition found. This condition is particularly common with field grafted vines."

When suckers are being removed scion roots must therefore receive careful attention, and be cut off flush, with a sharp knife. A second visit later on is advisable.

Grafting a couple of inches above the surface level as already recommended (see *Journal*, September, 1917, page 557) no doubt minimises scion root trouble. Nevertheless, a few are usually thrown out, and these must be attended to. It is not always possible, however, to graft thus high. At the original planting of the ungrafted rootling novices often plant too deep; they forget that the soil will settle, and the stock sink an inch or so. Cases may also occur when it is necessary to regraft, lower down, a stock which failed to take the previous season. Even

under these conditions, when the vine *must* be grafted somewhat below the surface, the scion root difficulty can be overcome, but at the cost of a little extra work and attention. If carefully suppressed a couple of times during the first year, and again during the second year, the union will be sufficiently perfect for there to be little tendency for the formation of scion roots later on. Nevertheless it is well to keep any grafts which have had to be executed below surface level, under observation for

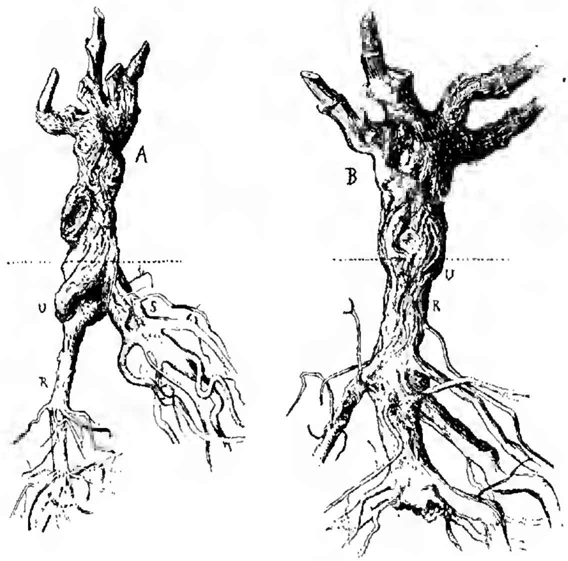

Fig. 8.—The Danger of Scion Roots.

[Reproduced from Bulletin No. 180, University of California Publications, *Resistant Vineyards*, by Professor Frederic T. Bioletti (redrawn after Viala and Ravaz).]

A.—Evil results of allowing the scion to form roots of its own. The scion roots (S) growing from above the graft (U) are strong, whilst the resistant stock (R) is stunted and worthless.

B.—A normal grafted vine, which has not been allowed to grow scion roots. The slightly larger diameter above the point where grafted (U) is usual with most resistant stocks.

a few years. A distinctive mark in the shape of a short stake, preferably painted white, or a loose wire collar round an arm of the vine, will permit regular inspection with a minimum waste of time.

Treatment of Grafts which have Failed.

Even though the graft may have failed altogether, the stock, if alive, is not lost. It may yet be converted into a vigorous and fruitful vine.

It must, however, be carefully attended to, and not left to itself. Suckers will be thrown out, usually in abundance; if these are all permitted to grow the stock will, by the end of the season, have become quite hopeless. None of the canes fit to graft, and re-grafting of the main stem would have to be done at such a depth as to render serious scion root trouble a certainty. If, however, all the suckers except two of the best situated ones are suppressed, these will attain sufficient strength to be fit to graft, with every hope of success, later on. A stock which was properly

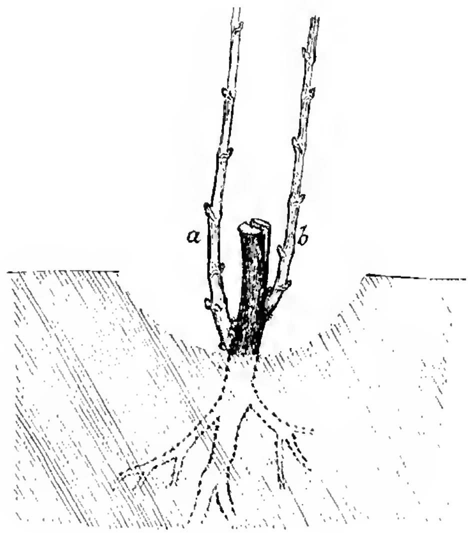

Fig. 9.—A Field Graft which Failed.

All suckers except two were removed in October or November; the two remaining ones will, by January or February, be stout enough to be "Yema" grafted at *a* and *b*; or they may be grafted (cleft or whip tongue) the following spring. Should both grafts take, the weaker one is subsequently suppressed.

disbudded in spring would, at the end of the season, present the appearance shown in fig. 9. The two stout canes may be either cleft or whip tongue grafted at *a* and *b*. Should both grafts take, the less satisfactory one is suppressed later, the better one alone being retained.

The selecting of two suitable suckers can best be done when the grafts are being visited for sucker removals. All, with the exception of the two selected ones, must be broken out, or better, cut off flush, with a sharp knife.

It is not, however, necessary to wait a whole year in order to re-graft. Several courses are open. Herbaceous grafts* of various types may be practised in December, the canes may be Yema bud-grafted from January to March, or they may be grafted (either cleft or whip-tongue) in the following spring. Re-grafting in this way on a couple of strong canes is much more satisfactory than re-grafting, lower down, on the main stem.

An ingenious method of dealing with what at first sight seems a quite impossible stock, came under the writer's notice recently. Owing to unsuccessful grafting and re-grafting, the stock consisted of a twisted knot of suckers and roots, quite hopeless to even a skilled grafter. The resourceful vigneron opened up the stocks so as to bare the main roots. In each case one of the stoutest or most favorably situated of these was straightened up to surface level, and grafted in the usual way. The main stem was entirely removed, and the remaining roots likewise, as far as they could conveniently be run. The grafted root was, needless to say, kept in the line of the wire; true, it was slightly out of its exact position in the row, but in trellised vines this is of little consequence. Knitting and subsequent growth were altogether satisfactory, and this method of dealing with a difficult case certainly merits recording.

From the above it will be seen that field grafting of the vine is not a difficult or complicated matter as intending vine-growers in several new districts seem to imagine. In certain areas which have the good fortune to be so far free from phylloxera (and may they long continue so), illogical though it will appear to any thinking person, vineyards are still being planted with vinifera root (not grafted on resistant stock), and this notwithstanding the fact that "clean" resistants are available. Being unfamiliar with it, growers are so afraid of the operation of grafting that they prefer the sword of Damocles in the shape of the appearance of phylloxera, which must ultimately, but inevitably, invade all districts of Australia.

And yet in the Rutherglen district, where the presence of phylloxera has made the resistant stock an absolute necessity, field grafting has now no terrors, especially for the careful small grower, who takes pride in his work, and does it himself. Many such prefer reconstitution by means of field grafting to the planting of grafted rootlings, though the latter method is generally preferred by larger growers, who must depend on hired labour.

The field grafter can "Yema" graft in February following plantation; any failures (and there are usually few) can be spring grafted the following September to November; and should any of these fail, if the stocks were properly disbudded so as to insure a couple of stout canes, these can be re-grafted by the various methods described above. With so many strings to his bow the field grafter has practically the same chance of getting near the 100 per cent. ideal as the planter of grafted rootlings; true, a certain amount of extra care and attention will be necessary, but not really so much as is usually feared by those as yet unfamiliar with reconstitution.

* See "New Methods of Grafting and Budding as applied to Reconstitution with American Vines," compiled and translated by Raymond Dubois and W. Percy Wilkinson, obtainable from this Department, price 7d., post free.

THE REARING OF CALVES ON SUBSTITUTES FOR MILK-FAT AND MILK.

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[Reprinted from the *Journal of the British Dairy Farmers' Association*, Vol. XXIX, 1915.]

Owing to the present high price of new milk in this country and to the production of cheese, cream, and butter at remunerative prices, the use of whole milk for calf rearing, for any length of time, is much too costly a practice; and as there has been a good deal of experimental work carried out in various parts of the world with separated milk and milk-fat substitutes, which have proved highly satisfactory, I propose summarizing the most important results.

As to rearing calves altogether, without some portion of separated milk, *i.e.*, on milk substitutes pure and simple, there is considerably less information available, this, however, will be referred to later.

As we heard at the Dairy Conference in Ireland last year, and as is generally recognised, the heavy milking cow is *bred* and not made. Heifers descended from heavy milking dams are far more likely to turn out heavy milkers themselves than when descended from poor milking strains; and it is most regrettable, from the point of view of the Dairy Industry of the future, that many of these well descended calves are disposed of as soon as dropped, either to be vealed, or, as in too many cases, to be subsequently converted into beef. It is because of this fact that I bring forward the suggestions contained in this paper, hoping that perhaps, where calves have been disposed of heretofore, as just mentioned, it may seriously be considered whether some of them at least cannot be retained at home and economically reared, to be later brought into the dairy herd.

This treatise does not pretend to be exhaustive, as time will not allow of dealing with so large a subject at such length as it deserves.

There are on the market numerous proprietary calf meals varying in price from £13 to £20 per ton, and which are, from their contents, as revealed by analysis, much too expensive. These meals contain linseed, linseed-cake meal, and oatmeal, with a little fenugreek or fennel added, which gives them their characteristic odour.

It is not so difficult a matter to find a fat or milk substitute for calves of a similar chemical analysis to that of milk, but it is difficult to do so without introducing also a large amount of fibrous matter, which is liable to upset the delicate digestive tract of the calf, resulting in scour. And if it escapes this scourge, we get a final result which is quite characteristically described as "pot-bellied," a condition which is the very opposite to that which a properly nourished calf should present.

I should here like to acknowledge my indebtedness for some of the information contained in this paper to the Irish Department of Agriculture, the Agricultural Department of Leeds University, Aberdeen University, and to other stations, which will be referred to in

their place. The figures I give will not be exactly those found in the reports compiled by these bodies, as it has been necessary to make fresh calculations on other bases, in order to make the experiments of these institutions comparable with one another.

In the experiments referred to, the calves have been kept under observation, not only during the rearing period, but also up to the time they reach 1½ to 2½ years of age, so that the influence, if any, of the early feeding, could be gauged.

I would like to draw your attention, in the first place, to the experiments carried out by the Agricultural Department of the Leeds University. These experiments had for their object the demonstration of rearing calves on separated milk and cod liver oil. The results are given below, and they represent the conclusions obtained from *five* series of experiments carried out at the Garforth farm during the years 1899-1903, with more than fifty calves. The whole milk was valued at 8d. per gallon, and the separated milk at 2d., and cod liver oil at 5s. per gallon. For comparison the returns on valuing whole milk at 6d. and separated milk at 1d. are also included.

SUMMARY OF LEEDS UNIVERSITY EXPERIMENTS IN CALF REARING.

	Lot 1.	Lot 2.
Number of calves	23	29
Foods	Whole milk.	Separated milk and cod liver oil.
Age of calves at start, in weeks	6	6
Age of calves at weaning, in weeks	24	24
Average weight of calves at start (lbs.)	132	132
Average weight of calves at weaning (lbs.)	359	305
Average increase for experimental feeding	227	173
Average cost of experimental feeding	£6 5 0	£2 3 3
Average cost per lb. of increase	6·91d.	3·03d.
Average live weight (lbs.) when sold fat at 2½ years	1,193	1,152
Value per head, 60s. 8d. per cwt. dead weight	£18 13 3	£17 17 8
Balance, after deducting cost of experimental food	£12 8 3	£15 11 0
Balance in favour of separated milk and fat substitute	...	£3 2 9
Balance if whole milk is valued at 6d. and separated milk at 1d.	..	£2 12 1

It will be seen that there remains as balance a very appreciable sum in favour of separated milk and cod liver oil over whole milk, viz.:—

£3 2s. 9d. with whole milk valued at 8d. and separated milk at 2d. per gallon.
and £2 12s. 1d. ,, ,, ,, 6d. ,, ,, 1d. ,,

In addition to the foods mentioned, all calves received a gradually increasing quantity of a mixture of equal parts of bran and linseed cake during rearing, until at weaning this had increased to 1½ lbs. per head daily.

The next experiments I refer to are those carried out by the Department of Agriculture for Ireland during the years 1901-1903, consisting of three separate series, with a total of fifty-four calves divided into three lots.

	Lot 1.	Lot 2.	Lot 3.
Number of calves	19	17	18
Foods	Whole milk	Separated milk and cod liver oil.	Separated milk and meal mixture.*
Average age in weeks of calves at start	$4\frac{1}{4}$	5	5
Average age in weeks at weaning ..	23	23	23
Average weight of calves at start (lbs.)	119	121	129
Average weight of calves at weaning (lbs.)	427	381	404
Average increase for experimental feeding (lbs.)	308	257	275
Average cost of experimental foods ..	£7 7 0	£2 13 7	£2 10 4
Average cost per lb. of increase ..	5·72d.	2·50d.	2·19d.
Average weight (lbs.) when sold as stores at 18 months	830	768	771
Value per head at 25s. 2d. per cwt. live weight	£9 7 7	£8 13 2	£8 12 4
Balance, after deducting cost of experimental foods	£2 0 7	£5 19 7	£6 2 0
Balance in favour of separated milk and fat substitutes	–	£3 19 0	£4 1 5
Balance if whole milk valued at 6d. and separated milk at 1d.	—	3 4 8	£3 7 3

In these experiments again it will be seen that very economical results have been obtained in feeding separated milk and fat substitutes.

Each lot of calves also received linseed cake as soon as they would eat it, in small quantities at first, but gradually increased, so that at the time of weaning they had 1 lb. per head daily.

The Department of Agriculture for Ireland were so satisfied with the results of feeding with this meal that they now recommend it to Irish farmers as a standard milk-fat substitute.

The following experimental results were obtained by the N.E. of Scotland Agricultural College at Aberdeen from 1908-1911, with three series of experiments on forty-four calves in all, divided into three lots. The object here being to compare the value of cotton seed oil with cod liver oil, as the latter has very much increased in price, while the former was obtained at 2s. 7d. per gallon.

	Lot 1.	Lot 2.	Lot 3.
Number of calves	14	15	15
Foods	Whole milk	Separated milk, cod liver oil, and meal*	Separated milk, cotton seed oil, and meal†
Average age of calves in weeks at start	4	$4\frac{1}{4}$	4
Average age of calves in weeks at weaning	25	25	25
Average weight (lbs.) of calves at start	109	113	107
Average weight (lbs.) of calves at weaning	316	297	284
Average increase for experimental feeding	207	184	177
Average cost of experimental foods ..	£5 13 1	£2 1 11	£2 0 5
Average cost per lb. of increase ..	6·80d.	2·73d.	2·77d.
Average weight (lbs.) when sold fat (2 years)	1,153	1,130	1,095
Value per head at 65s. 8d. per cwt. dead weight	£19 1 7	£18 12 8	£17 14 3
Balance, after deducting cost of experimental foods	£13 11 6	£16 10 8	£15 13 9
Balance in favour of separated milk and fat substitutes over whole milk..	-	£2 19 2	£2 2 3
Balance if whole milk is valued at 6d. and separated milk at 1d. ..		£2 2 4	£1 4 8

* This meal consisted of :—1 part ground linseed ; 2 parts maize meal ; 2 parts oatmeal. This meal was mixed with sufficient boiling water to make a thick gruel and allowed to stand twelve hours before being fed along with the separated milk.

† The meal consisted of :—2 parts whole linseed, finely ground ; 1 part fine oatmeal; 1 part of wheat meal ; and cost 16s. per cwt.

The results of these experiments show, as also do those previously considered, that not only is there a great gain over whole milk feeding, even when valuing whole milk as low as 6d. per gallon, by substituting separated milk and fat substitutes, but that the live weight increase after weaning is almost as good in the case of calves reared on separated milk and milk-fat substitutes as with those fed on whole milk. True, the whole milk gives the greatest increase in live weight during rearing, and no substitute comes up to it in this respect if the cost is not taken into account, but the increase is obtained at so great a price as to make it entirely incommensurate with the value of the increase. Calves, after they have reached a month to six weeks of age, can be quite economically and profitably reared without any whole milk at all. A calf up to a month old will require only from 20 to 25 gallons whole milk.

It should be mentioned that the calves were given linseed cake in small quantities, this amounted to ½ lb. per head daily at time of weaning. They also had hay and grass *ad lib.*

The milk was run through the separator immediately after milking, and the separated milk fed to the calves soon after.

The oil was measured out for each calf in fluid ounces, and poured into the apportioned quantity of separated milk in the bucket aud well stirred.

In other experiments it is recommended that the oil be first put into the bucket, the proper quantity of separated milk poured upon it, and then well stirred; this insures thorough mixing.

The oils were gradually introduced, commencing with one fluid ounce. The weighed quantity of meal for the whole lot of calves was made into gruel with hot water, and a measured proportion of this gruel given to each calf when it was cool, along with the separated milk.

The daily quantities of the experimental foods per calf were those fed under average conditions, and as they form a useful guide in general practice they are here reproduced.

Experimental Food per Calf.

Lot I. Whole Milk.

1st four weeks of experiment	1 gall. whole milk daily.
2nd, 3rd, and 4th weeks of experiment	1¼ galls ,, .. ,,
5th four weeks of experiment	1 gall. ,, .. ,,

Lot II. Cod Liver Oil.

	Whole Milk.	Sep. Milk.	Cod Liver Oil.	Meal.
1st week of experiment ..	⅔ gall. ..	⅓ gall. ..	.. ..	2 oz. daily.
2nd ,, ,, ..	⅓ ,, ..	⅔ ,, ..	.. ..	4 ,,
3rd and 4th weeks of experiment	— ..	1 ,, ..	1 fluid oz. ..	4 ,,
2nd four ,, ,, ,,	— ..	1 ,, ..	2 ,, ..	6 ,,
3rd ,, ,, ,, ,,	— ..	1 ,, ..	2½ ,, ..	6 ,,
4th ,, ,, ,, ,,	— ..	1 ,, ..	3 ,, ..	6 ,,
5th ,, ,, ,, ,,	— ..	1 ,, ..	3 ,, ..	4 ,,

Lot III. Cotton Seed Oil.—Same as Lot II., except that cotton seed oil was used in place of cod liver oil.

It is not to be assumed that the fat substitutes mentioned in the three lots of experiments just recorded are necessarily the best it is possible to obtain.

In Leaflet No. 142 of the Board of Agriculture and Fisheries, the following are recommended—in addition to cod liver oil.

(*a*) Boiled linseed.

(*b*) Ground linseed.

Ground linseed cake is also referred to, but it is correctly pointed out that ground linseed cake is not sufficiently rich in oil to make up the requisite amount of fatty matter when added to separated milk.

Further, in America much calf rearing is done and recommended by the Department of Agriculture in the form of feeding the separated milk and meal separately. The meal is given to the calves in the dry condition, the calves are taught to feed when from seven to ten days old, by placing a little of the grain in their mouths after feeding the milk, and in this way their attention is called to the meal instead of sucking each other's mouths, ears, &c. They soon learn to eat the meal greedily.

The Department state clearly it is not advisable to mix any starchy meals with the milk. The starch of the meal is intended to take the place of the fat of the milk, and its form must be changed to sugar before it is digestible. This change is largely effected by the saliva of the mouth. If the grain is gulped down with the milk, there is no time for the saliva to act, hence intestinal troubles follow.

The recommendations of the Kansas Experimental Station, United States of America, are: That separated milk can be introduced gradually (1 lb. separated milk substituted for 1 lb. milk until all the latter is replaced) when the calf is fourteen days old.

At seven-ten days age the calf is taught to eat grain as described above. The grain which gave the best result was a mixture of Kaffir corn (millet) ground and whole maize. As Kaffir corn forms the chief diet of some millions of human beings, it is not to be wondered at that it makes a suitable food for calves.

Maize fed whole proved better than when fed as meal, while Kaffir corn fed as meal gave the better results than when fed whole. The grain was given in amount averaging 1 lb. per head for the whole rearing period of seventeen weeks.

The results obtained with 130 calves, divided into thirteen series, gave an average daily gain in live weight of 1.58 lbs., against the Yorkshire 1.37 and the Aberdeen 1.27 daily gains with separated milk and cod liver oil.

I have been informed by the Secretary of the Irish Department of Agriculture that experiments are in progress in Ireland on the subject of feeding starchy meals to calves in the dry condition, but up to the present there seem to have been no experiments carried out in Great Britain in feeding the meal which forms the fat substitute in the dry state, with one exception; yet in America it would appear to be the almost universal custom in some States.

The exception in Great Britain, where meal has been fed in the dry condition, is in the experiments carried out by Dr. Voelcker for the Royal Agricultural Society at Woburn during 1913-13, a report of which has been furnished to members of the above society.

In these experiments there were five lots of calves, consisting of four calves in each lot. The foods fed were as follows:—

Lot I. Separated milk and Cod Liver Oil.
,, *II.* Separated milk and a purchased "Calf Meal."
,, *III.* Separated milk with a gruel made of Linseed and Oatmeal.
,, *IV.* Whole milk.
,, *V.* Separated Milk and Crushed Oats.

The report states: "It is of importance to note that the crushed oats were always given *dry*, and never mixed up with the milk or made into a gruel."

That the feeding of starchy meals to calves in the *dry* state is very satisfactory under English conditions also is proved by the results obtained in these Woburn experiments, which were as follows:—

Lots.		Average Gain per Head daily in lbs.		Average Cost per lb. of Increase.
I.	..	1·90	..	3·33d.
II.	..	1·75	..	2·77d.
III.	..	1·57	..	3·15d.
IV.	..	2·00	..	5·39d.
V.	..	2·19	..	2·52d.

Experiments carried out in Italy* at the Royal Agricultural College, Milan, during the years 1905-11, with 116 calves fed with margarine emulsified in separated milk and starch treated with a ferment (*a*) diatoline extracted from malt, or (*b*) levuline (used by bakers for bread-making in Italy), have given excellent results, but the calves were fed for veal, and the after-influence consequently could not be gauged. Still it points to the possibility of using margarine, which, in bulk, may be obtained from 50s. to 60s. per cwt. It, however, requires some considerable amount of preparation; an emulsifier must be used to thoroughly disseminate the melted margarine throughout the separated milk.

The simplest solution of making up the separated milk in fat contents seems to lie in the employment of a suitable animal or vegetable oil which can be easily mixed with the separated milk, and obtained at a price of not more than 5s. or 6s per gallon. The cotton seed oil which gave such good results in the Aberdeen experiments costs 2s. 7d. per gallon, and it was pointed out that its use was accompanied by no ill effects. It may be noted also that it is largely used for food purposes for human consumption at the present time.

It is very important in using cod liver oil to see that it is fresh and not rancid, as there have been cases of mortality when rancid oil has been fed to calves.

In the Kansas† experiments above referred to, tests were carried out with *milk substitutes*, entirely replacing the whole milk, such as—

(*a*) Butter-milk, with Kaffir corn and whole maize fed dry, the calves were fed for eighteen weeks, ten calves on separated milk and corn and ten on butter-milk and corn.

The butter-milk calves increased on an average 1.79 lbs. daily and the separated-milk calves increased on an average 2.02 lbs. daily.

Although the butter-milk did not give such good results as the separated milk, yet the gains are very satisfactory and point distinctly to the advisability of using butter-milk in the absence of separated milk, and where the former is produced at home or somewhere in the neighbourhood. It would appear from the experiments that the butter-milk was gradually introduced to displace whole milk when the calves

* Monthly Bulletin of Agricultural Intelligence and Plant Diseases, August, 1913.
† Bulletin No. 126, May, 1904, Kansas State Agricultural College.

were three or four weeks old, by substituting 1 lb. at a time, as was the case with the separated milk.

(*b*) WHEY.—Whey, unlike separated milk, is not whole milk minus the fat only but minus the casein as well.

Whey was introduced gradually with calves aged from three to five weeks and a mixture of Kaffir corn and sifted oats fed dry, with as much meadow hay as the calves would take. It required two weeks to completely displace the whole milk. One to one-and-a-half gallons of whey were fed daily, but the calves needed watching, and the whey was withheld if any tendency to scour showed itself. The grain, however, seemed to counteract this tendency. No records are given as to the final weights, but it is remarked that the calves at the end of the experiment looked as well as the average separated milk-fed calves on the farm. One cannot see why cod liver or cotton seed oil added here should not have given even better results.

(*c*) HAY TEA.—Made by steeping hay in a copper of water and then boiling for one to two hours until 12 lbs. hay produced 100 lbs. tea. The tea was then fed in quantity similar to separated milk. ¾ lb. of linseed meal was fed after making into a jelly along with the hay tea. Hay was fed *ad lib.* and Kaffir corn and middlings fed dry. The gains in live weight were less than 1 lb. daily, viz.: .86 lb., and altogether the results showed hay tea to be unsatisfactory. It is a fact, however, that many calves have, in time past, been reared in England with a certain amount of hay tea, but as no statistics of live weight gains are available it is impossible to say whether they made satisfactory progress.

The last lot of experiments I wish to call your attention to are those carried out by Cornell University, 1907-1909.* After a satisfactory preliminary experiment with fifteen calves, another set of seventeen calves were divided into three lots.

Lot I. was fed separated milk and dry grain, the calves were fed all the dry grain they would clean up daily. It was mixed as follows:—

- 6 lbs. maize and oats (ground half and half by weight).
- 3 lbs. wheat bran.
- 1 lb. linseed meal.

Hay was kept before the calves at all times. Both the hay and grain were weighed daily for each animal and, in addition, each calf was given a tablespoonful of dried blood meal, but no charge has been made for this small amount. It was advertised as preventing scour and seemed to act as a tonic generally.

Lot II. received separated milk powder. The separated milk powder was simply ordinary separated milk dried by a patent process and delivered as a fine meal. It cost just over a 1d. per lb., and was prepared for feeding by adding 9 lbs. hot water to each 1 lb. powder.

Lot III. were fed with gruel made from Schumacher Calf Meal. This is a commercial product of the Quaker Oats Company, Chicago, and contains oatmeal, oat germ, wheatmeal, linseed, and condensed milk and cost 1¾d. per lb. This was fed as follows: Ten days to a fortnight old, whole milk; then two tablespoonfuls of meal to 1 pint boiling water, and 2 quarts milk were given night and morning. The meal was gradually increased, until, at the end of fourteen days, the calf received at each meal 1 quart whole milk, ¾ quart of meal mixed with

* Bulletin No. 269—Substitutes for Skim Milk in Raising Calves, July, 1909, Cornell University—Department of Agriculture.

1 pint cold water, and then 1 quart boiling water. Afterwards the feeding was as below:—

DIRECTIONS FOR FEEDING SCHUMACHER CALF MEAL.

Age of Calf.	Quarts Whole Milk.	Quarts Meal.	Quarts Water. Warm.	Quarts Water. Boiling.	
7–14 days	1	$\frac{1}{4}$	$\frac{1}{2}$	1	Twice daily.
14–21 „	1	$\frac{1}{2}$	$\frac{1}{2}$	1	
21–28 „	$\frac{1}{2}$	1	$\frac{3}{4}$	1	
28–120 „	No milk	1	$\frac{3}{4}$	$1\frac{1}{2}$	

The details of the experiments were as follows:—

	Lot I.	Lot II.	Lot III.
Number of Calves	7	6	4
Foods	Separated milk and grain	Separated milk powder	Schumacher calf meal.
Age of Calves at start	birth	birth	birth
Average age in weeks at weaning	22	22	22
Average weight (lbs.) of calves at birth	73	69	64
Average weight of calves at weaning	301	252	227
Average increase for experimental feeding	228	183	163
Average cost of experimental feeding	£2 10 5	£2 8 0	£2 14 0
Average cost per lb. of increase	2·65	3·14	3·97
Average gain in lbs. per head daily	1·53	1·23	1·10

Lot I.—Consumed 20 galls. per head of whole milk only ..
Lot II. „ 18 „ „ „ ..
Lot III. „ 22 „ „ „ ..
} Before being fed entirely on the milk substitutes.

The calves thus reared were kept to be brought into the dairy herd, and although weights are not given, showing their later rate of increase in live weight, it is reported that the animals of the different lots appeared to possess equally good constitutional vigour.

It will be noticed that the cost per lb. of live weight increase was very satisfactory as compared with that made in the experiments already described.

It may perhaps be considered that I have not solved the question of how to rear calves on milk substitutes, as Lot II., though not fed milk in the dry condition, were fed the dry matter of milk, and that the food of Lot III. contained at least a little condensed milk. All I can say is that at present there appear to be no really good milk substitutes for calf rearing generally available, but assuming the milk producer makes butter or cheese, he has separated milk or whey to fall back upon, which, as has been shown, can be usefully employed for the purpose; and if he sells all his milk, he can, if procurable, purchase separated milk up to at least 3d. per gallon, and raise calves economically on it (and cotton seed oil) even at that price.

Should separated milk powder* be available at less than 3d. per lb., it would seem to form a fairly economical food on which calves can be profitably raised, if fed with cod liver oil or some food butter-fat substitute.

In conclusion I need only emphasize the importance of strict cleanliness in all matters connected with calf rearing: the scalding of the feeding buckets and other utensils in which the food is fed or stored, lime-washing the walls of the calf-pens periodically, and the use of sufficient bedding material for the calf to have a dry bed at all times. Cleanliness is the chief factor, and because a man finds he is unable to rear calves on milk fat or milk substitutes, which others have found satisfactory, may be due to the neglect of these points, and not to any faultiness of the food.

* This product is now obtainable in England from the West Surrey Central Dairy Co. Ltd., Guildford, and from their branches and factories at Wincanton, Sherborne, and Beaminster.

COMMONWEALTH ADVISORY COUNCIL OF SCIENCE AND INDUSTRY.

ABSTRACT OF REPORT BY EXECUTIVE COMMITTEE.

The Executive Committee of the Commonwealth Advisory Council of Science and Industry has issued a report covering the progress of its work since the date of appointment of the Committee (14th April, 1916) to the 30th June, 1917. The report is divided into eight parts, dealing respectively with—1. Introductory matters; 2. The policy and general nature of the work of the Executive; 3. The collection of information; 4. Investigational work; 5. The Bureau of Information; 6. The State Committees; 7. Finance; and 8. Conclusion. The Advisory Council is a temporary body established for the purpose of preparing the way for the proposed permanent Institute of Science and Industry. It consists of 35 members, representing science and industry in all the States, in each of which there is a State Committee.

A large amount of information has been collected, for the use of the Executive and State Committees and of the proposed permanent Institute of Science and Industry, regarding Australian industries, their distribution, technical and scientific problems connected with them, the equipment and *personnel* of laboratories available for industrial scientific research work in all its branches, research work in actual progress in laboratories, experimental work in progress at Government experimental farms, and the facilities available for the training of scientific investigators. The results of these inquiries have been analyzed and summarized in tabular form as far as practicable, and the information thus gained will largely form the basis for the activities of the future institute. One of the first conditions essential to the success of the movement for the application of science to industry is a largely increased supply of competent research men, and the report emphasizes the necessity for more adequate provision in this direction.

A considerable amount has been done by the Executive in establishing relations with other interested authorities, including State Governments, scientific and technical departments, universities, technical colleges, scientific societies, and associations representing the pastoral, agricultural, manufacturing, and other industries. As regards the initiation of researches, no fewer than twenty Special Committees have already been appointed. These Committees consist of experts representing both the industrial and the scientific sides. In many cases, salaried investigators have been appointed to carry on the research work under the general supervision of the respective Special Committees. Much benefit has been derived from the combination of the industrial and scientific points of view on these Committees. In order to carry on the research work, the co-operation of laboratories already in existence has been secured.

A considerable part of the report is devoted to the results of the investigational work carried out. As regards the agricultural and pastoral industries, special attention has been given to the control and eradication of pests and diseases of stock and crops. The loss caused, directly and indirectly, by the attacks of pests, parasites, and organisms

causing disease amounts in Australia to millions of pounds yearly. The most important of these are the cattle-tick, the worm which produces nodules in beef, the sheep blowfly, and the tubercle bacillus. Special Committees have reported upon the tick-pest and nodule disease, and have formulated lines of action with a view to their control. The subject of tuberculosis in stock has been investigated by a Sub-committee of the Queensland State Committee, and its report has been published by the Queensland Government.

In connexion with the control and eradication of weed pests, special attention has been given to the prickly pear. Already some 20 million acres of land in Queensland and 2¼ million acres in New South Wales are infested with prickly pear, and it is estimated that the pest is spreading at the rate of 1,000,000 acres a year. A report, with recommendations for a scheme for the control and eradication of the pest, has been presented by the Committee to the Federal Government. Various other weed pests have engaged the attention of the Committee. For example, in the case of St. John's wort, inquiries are being made with a view to introducing some insect which feeds exclusively on that weed in England, of which country St. John's wort is a native. This method of dealing with weeds—the introduction of the insect foes which keep them within bounds in their native countries—has already been found effective in other countries.

As regards the cultivation of new or improved crops, special attention has been given to cotton and flax, in the case of the former, with a view to the introduction of a mechanical cotton picker, and, in the case of flax, with a view to the adoption of some chemical method of retting the fibre. A large amount of information has been collected, and plans are being formulated with a view to large scale experiments. Several other matters connected with the agricultural and primary industries have engaged the attention of the Committee. Chief of these are the questions of a soil survey of Australia, the branding of cattle, the introduction of the sparrow-pest into Western Australia along the transcontinental railway route, and the breeding of new varieties of cereals and fodder plants suitable for dry areas.

In connexion with forests products, special attention has been given to the production of wood pulp, destructive distillation (for methyl alcohol, acetic acid, tar, and inflammable gases), and the utilization of waste timber. Two investigations have been initiated with a view to increasing our supplies of tannin, viz., the tanning properties of mangroves in Queensland and of redgum in Western Australia. Other investigations into vegetable products include the production of dyes and of camphor and the utilization of grass trees.

As regards fisheries, a Special Committee is investigating the marine biological economics of tropical Australia, with special reference to pearling, bêche-de-mer, trochus, and sponges. In connexion with the mining and metallurgical industries, the most important researches are those concerned with the manufacture of ferro-alloys and the occurrence of gold in quartz, the object of the latter investigation being to determine the principles which have led to the localization of payable gold, and thus, among other things, cheapen the cost of deep prospecting.

A large number of questions connected with the chemical industry have been considered by the Committee. Many of the questions have

however, been found to present no unsolved scientific or technical problems, the difficulties being mainly fiscal or economic. One matter of special importance is the production of fertilizers, especially of potash, for the supply of which Australia was dependent before the war on the deposits at Strassfurt, Germany. Various sources of potash, including alunite, kelp, suint, molasses, and wood ashes have been considered, and a Special Committee investigating the production of potash from the deposits of alunite in New South Wales and South Australia has almost completed its work. Among other chemicals dealt with may be mentioned lanoline, cream of tartar, copper sulphate, casein, pepsin, rennet, starch, glucose, and industrial alcohol.

In the manufacturing industries special attention has been given to the improvement in tanning methods, paper making, the utilization of posidonia fibre (of which there are immense deposits in Spencer's and St. Vincent's gulfs, South Australia), pottery, and clays, the manufacture of solid-drawn cylinders for holding compressed gases, the design and manufacture of alcohol engines, the sterilization of milk, and the fermenting power of yeast. In regard to the last-named, the results already obtained afford hope that they may have an important bearing on the solution of the day-baking trouble by reducing the time of the dough in the trough.

In the report considerable importance is attached to the question of standardization, and in this connexion a beginning has been made by the temporary organization in regard to—(*a*) Analytical methods in the chemical industry; (*b*) The design of scientific apparatus; (*c*) The appraisement of alcohol in spirituous liquors; (*d*) The metric system and decimal coinage; and (*e*) Standardization in the electrical industry.

One of the important functions of the proposed permanent institute is the establishment of a Bureau of Information. The temporary organization has made a beginning in this direction by appointing a science abstractor, who has been engaged in preparing abstracts, bibliographies, and card indexes of references to articles in scientific and technical journals. A room at the Public Library has been placed at the disposal of the Committee by the Trustees.

A report from each of the State Committees is included in the report of the Executive. These State Committees play a very important part in the work of the Advisory Council. The total expenditure incurred by the Council up to the 30th June last is £3,593.

Many large problems to which the Executive Committee have given consideration—such as the tick-pest and the nodule disease in cattle, and the utilization of forest products—involve issues that are too large and complex to enable them to be further dealt with efficiently under the existing temporary organization with its limited financial powers and executive authority. Moreover, action in connexion with certain of these matters can be carried out by the Federal Government only with the co-operation of the State authorities, so that the relations between the proposed permanent institute and these authorities must be determined before any comprehensive lines of action can be adopted.

In conclusion, it is pointed out that the Executive and State Committees have largely performed the functions for which the temporary Advisory Council was created, and have thus prepared the way for the work of the permanent institute.

THE HOUSE FLY.

By J. W. McKenzie, Dairy Supervisor.

It is to be feared and regretted that the common house fly (*Musca domestica*) is not generally recognised as being a most active disseminator of filth and disease. A study of its life history and habits leaves one amazed at the toleration and indifference displayed towards a pest as repulsive as it is dangerous. It is incumbent upon dairy supervisors and Board of Health inspectors to give effect to provisions of law, compelling manufacturers of and traders in foodstuffs to protect their wares from contamination by flies, and their efforts have had a salutary effect upon tradesmen found lax in their methods. Much good work by supervisors and inspectors is, however, nullified through apathy, carelessness, and ignorance on the part of housekeepers given to methods favorable to pollution of food by flies in the home.

Towards the beginning of summer, the remnants of the preceding year's countless army of flies will crawl drowsily from the chinks and crevices which have afforded them shelter during the winter. Their ranks are reinforced by the generation whose members about the same time emerge from their pupa cases, and with all the energy of youth are ready to sally forth upon their disease-spreading career. After having gorged themselves upon any food left accessible to their greed, the production of a further generation is proceeded with. The female lays about 120 dull, chalky-white, elongated eggs, about 1-25th to 1-20th of an inch in length at a time. This performance is repeated three or four times in a season. Upon pieces of meat, house refuse, or in accumulations of manure, the eggs are deposited, and within a few hours white footless maggots (larvæ) are hatched, and these at once voraciously attack the organic matter close at hand. Although the larvæ finds other bacteria thriving and multiplying in the same repulsive surroundings, there is no pitched battle between them. On the contrary, the larvæ finds a useful ally in the bacteria, as it liquifies that portion too solid for the tender jaws of the young maggots; they, in return for this service, expose fresh surfaces of food for the bacteria. In favorable circumstances the maggot attains its full size (from ¼ to 2-5th of an inch) in five days, and, having reached maturity, ceases to eat, and changes into a chrysalis or pupa, a dark-red object, about ¼ inch long, enclosed in a hard tough case. The pupa lies in the food substance or on the ground for a period of from five to fourteen days, and during this time changes into a fly. At first, flabby and soft, though fully grown, when it leaves the pupa case, its wings are only partially developed; but in a short space of time its skin hardens and the wings expand. The fly is provided with a proboscis or trunk-like attachment to the head. This trunk terminates in a tip, which, when the insect is feeding, expands into an oval disc. This disc is connected with numerous channels converging towards the gullet. These channels pass into the thorax. A pumping organ near the proboscis enables the fly to suck up liquid sustenance. The gullet is divided in the thorax, and both branches pass into the hinder part of the abdomen. A large sac—the crop—is connected with one branch, while the other passes into the

intestine proper, where the food is digested. Most of the food taken goes first into the crop, which has a twofold function. In the first place, it is used as a reservoir, where a reserve of food may be stored for a time of scarcity; and, secondly, it enables the fly to secure rapidly and carry off food sufficient to last it several days, the liquid from the crop being used to moisten and dissolve such dry foodstuffs as sugar. Having feasted, the fly exudes fluid from the tip of the proboscis; the cause of this may be that the crop has been distended to an uncomfortable degree, and that it obtains relief by regurgitation of food. But little reflection upon this habit, with the knowledge of the fly's equal partiality for sputum, excrement, &c., and the common human foods, and that it passes from one to another in rapid succession, make even the least thoughtful better able to appreciate the danger of infection and pollution of sugar, milk, meat, &c. The feet of the fly are of the nature of adhesive pads, and are ideal vehicles for the distribution of pathogenic organisms. The insect's excrement, which may be voided 50 times a day, is a further source of infection.

The following facts are gathered from a work by C. Gordon Hewitt, D.Sc., F.R.C.S.:—"Among the organisms menacing human life and proved to be distributed by flies are typhoid bacilli, which may remain alive in the intestine of the fly for six days; and flies affected with this bacilli may infect material on which they walk for at least two days. Similar results have been observed in respect of the meat-poisoning bacilli. Ten days or more after infection, tubercle bacillus has been found in the intestine of the fly. Spores of the anthrax bacillus have been proved to remain on the legs and in the intestines of flies for at least twenty days. Excrement passed fourteen days subsequent to infection has been found to contain living spores; and if the fly died with the spores in or upon their bodies, these spores might remain alive for months, or even years."

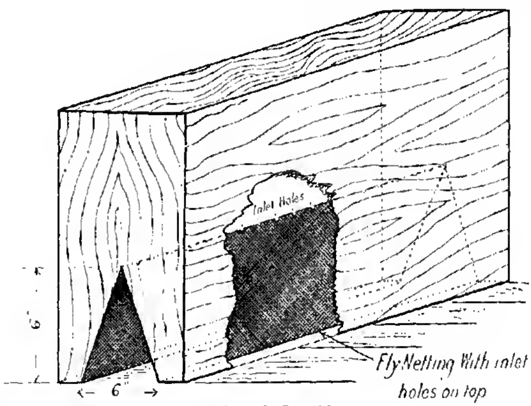
Clean flies will infect themselves by sucking at the vomit spots and excrement of their infected fellows, and as flies can rapidly travel considerable distances, infection may be carried from a distant source. Experiments have been conducted in which flies were, within 35 minutes, recaptured 1,700 yards from the point of liberation.

In Victoria during the year 1915, the deaths of 71 infants were attributed to intestinal troubles, and 74 per cent. of these deaths occurred during the five months between December to April, during which period of the year the fly is always most active. During the other seven months, when the pest is inactive, only 26 per cent. of the deaths occurred. The prevalence of ophthalmia is almost entirely due to infection by flies, and the preponderating number of cases among infants compared with adults is due to the helplessness of the former to protect their eyes from attack by flies.

Speaking of the spreading of disease by flies, Dr. Hewitt says:—"Malaria in India alone claims one million victims each year; the disease being conveyed by the mosquito. Plague, which has created terrific devastations each year, was found to be transmitted by the flea. Sleeping sickness is caused by the tse-tse fly. Lice transmit the causative organism of typhus. The stable fly is suspected of being the disseminator of infantile paralysis; but, of all revelations, perhaps none

affects so great a number of people in all countries, both by significance and effect, as the disease-carrying capacity of the common house fly."

Domesticated animals suffer very severely from the annoying attentions given them by flies. Horses are specially singled out for attack, and, in consequence, "ticklish" or "touchy" horses are frequently rendered unmanageable. The trouble is accentuated should an unfortunate animal suffer from any form of open wound. A pitiable sight indeed is that of a horse being persistently tortured through flies sucking at the tender surface of girth or saddle gall. Cows with sore teats suffer in the same way. It is recommended that such sores be dressed with carbolic oil two or three times a day, which, in addition to its healing properties, will keep the pest from the wounds. Individual attention is required in endeavouring to effectively handle the pest. In India, the semi-civilized native has been brought to believe that he deserves the title of dung-eater if he permits his food to be contaminated



Sketch of Fly Trap

by flies. The name to be given to the civilized man, who is indifferent to the ravages of the fly, is difficult to find and is probably unprintable.

In America, the fly eradication movement is rapidly gaining ground, and little doubt remains that, when the public clearly realizes the danger of infection, zealous action will be taken by every householder. It is most important that all breeding places should be abolished, and dust bins, earth closets, and refuse of all kinds, especially portions of meat, fish, fruit, and vegetables, should be rendered inaccessible to the fly. Yards and outbuildings should be kept in a state of scrupulous cleanliness, so that likely breeding places cannot possibly be overlooked. Special attention should be paid to the stable and cowshed; manure should be removed therefrom as often as possible. Milk spilt on the cowshed floor should be immediately washed off. Manure heaps should be sprayed with a solution of 8 oz. sodium arsenate to 20 gallons of water. Mr. R. J. Smith, in 1911, demonstrated that formalin with the addition of sweet milk, is very attractive to flies, and proves an excellent

bait. Two ounces of formalin to 1 pint of milk, exposed in shallow plates, with a piece of bread in the centre for the flies to alight upon, is the method suggested. The burning of pure prythenum powder, or 20 to 30 drops of carbolic acid on a hot shovel or like receptacle has been recommended as a means of ridding a room of flies. As the fumes do not kill all the flies, but only stupify a certain portion, flies should be swept up before they have an opportunity to recover.

In the Goulburn Valley district, a home-made trap is sometimes employed, and, as it has the merits of efficiency and cheapness, combined with simplicity of construction, it can be recommended. It consists simply of a box (a kerosene case is a handy size for a stable, byre, or out of doors, a smaller sized box will do for indoor use). The method of construction is as follows:—An opening is made in both ends of the box as shown in the illustration, and a piece if fly-proof wire is fitted over each aperture. This piece of wire has two or three holes about 3-16 of an inch in diameter placed near the centre, say, 3 inches apart, to allow the flies to enter. All that is then required is to hinge a portion of the case so as to form a door, and bait the trap with a fair-sized lump of stale crust of bread soaked in milk, which should be suspended from the roof of the trap by a wire or on a piece of tin. If the inlet holes were made somewhat larger and offal were used as a bait, this device could also be used as a blow-fly trap.

HINTS ON DRESSING A SAW.

By J. J. Ricketts, Dairy Supervisor.

Nothing detracts so much from the general appearance of farm or dairy premises as dilapidated buildings or fencing. Many homes could be altogether altered in appearance in comparatively little time by a handy man repairing broken gates and fencing and tidying up the places generally. Often, however, a man will put off such odd carpentry jobs, owing to his not having a suitable saw to work with.

On a farm there are many calls for the hand and crosscut saws, and in unskilled hands these tools soon get out of order and become almost useless, but by closely following out the instructions here set out any one should be able to put a saw into working order.

In dressing a saw, three operations are necessary, viz.—

(1) Stripping.
(2) Setting.
(3) Filing or sharpening.

Stripping, as it is termed, is making all the teeth of an even length by running a file flat on its side along their points. By this operation the longer ones are cut down to the level of the shorter. If the teeth are not uniform a saw will "run," *i.e.*, it will not cut straight, and a bad fitting joint in timber will result.

A very handy device for holding a file for this operation is shown in the figures in Plate 1, which enables a person to apply the same pressure all along the saw, and in addition acts as a guide for keeping the file parallel, thus obviating the danger of tearing the user's hand on the teeth.

Setting a Saw.—In this operation every alternate tooth is slightly bent along the full length of the saw, which is then reversed in the clamp and the remaining straight teeth are dealt with in the same way as the others. In setting a saw an operator should be very careful to see that the same amount of "set" is put on each tooth, for if one tooth is set more than another it will make the saw jump, and a rough, jagged cut in the timber results. In setting the teeth it is necessary to bend them just enough to allow the blade to move forward and backward freely, otherwise the set will be too wide, and will cause the cutting of unnecessary timber, and mean a waste of time.

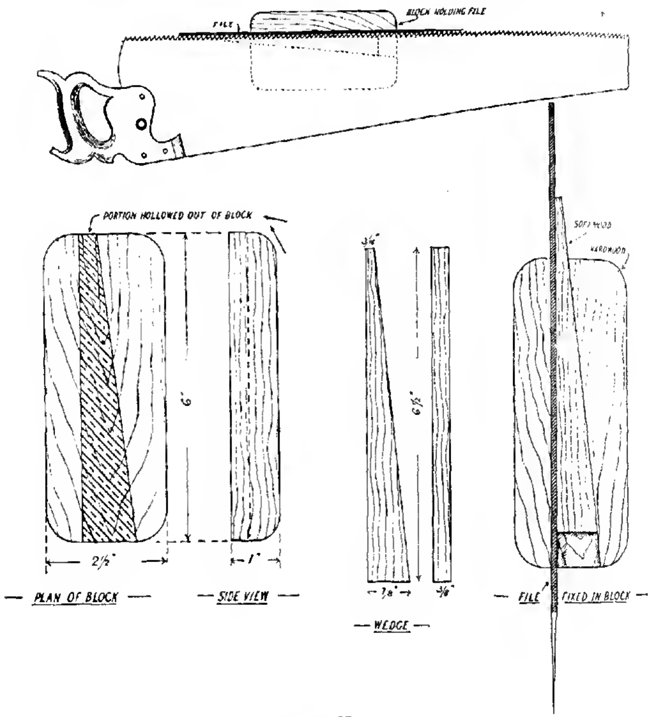


Plate No. 1.

There are many kinds of adjustable saw sets on the market, which can be purchased at from 3s. to 4s. 6d. For different timbers varying sets are necessary, green timber requiring more than dry. The adjustable set is therefore indispensable, as by its use the adjusting may be quickly performed and the set made perfectly regular.

In setting a crosscut, each tooth is treated as in the hand saw, but with an ordinary set, with gauge unattached. The gauge is a flat piece of metal with a small slot cut out of one corner, as shown in

Plate 2. This is placed on edge against the blade of the saw, the top being level with the point of the tooth. The set is then applied with a gentle pressure to bend the tooth until it will just touch the gauge on top, every second tooth on one side being treated in the same manner along the full length, and, after reversing the saw in the clamp, the other teeth may be dealt with.

Filing or Sharpening a Saw.—In sharpening a hand saw, a three-cornered file should be used, the grading varying with the class of work and kind of saw to be treated. A tenon saw requires a fine or

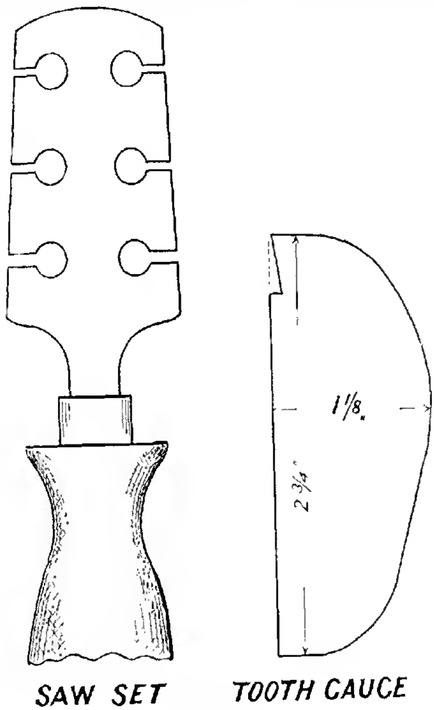


Plate No. 2.

small file, a coarser saw a larger file, and a rip saw a coarser file still. The file is inserted between each alternate tooth with a gentle, firm, even, forward pressure, the hand holding the file slightly downward, the point of the file being inclined towards the point of the saw. This position slightly cuts down into the blade, and keeps the teeth of uniform length. If the filing each time is done on the tooth and the blade is not cut into, the tooth is filed short, and the saw is very soon ruined. The file should be held slightly at an angle to the blade, *i.e.*, the point inclined away from the handle of the saw. In filing a crosscut

alternate teeth on each side should be filed on both edges, and by this action gums, or false teeth, are raised in the blade between each tooth. These gums must be kept down either by filing them straight across with the file flat on its side or by placing the saw flat and firm on its side on a solid piece of iron and marking with a cold chisel by striking the chisel a firm blow with a hammer, each gum being treated the same way on both sides of the saw. The gums then may be readily broken off by applying the saw set and bending them, in the same way as is done when setting the teeth.

Dressing must always be carried out in this order—stripping, setting, and filing or sharpening. If the teeth be sharpened prior to being set, the points will be dulled when brought into contact with the set, and consequently, at the conclusion of the operation, the saw will still be unfit to perform good work.

SHEEP DIPPING.

By A. W. Curlewis, Inspector of Stock.

During last season certain points which are of interest to sheep-owners came directly under observation. The one which calls for comment just now is the very marked increase in the number of sheep infected with lice compared with other recent years, excepting the drought season of 1914-15. This is chiefly due to ineffective dipping rather than to failure on the part of owners to dip their flocks. Dipping has proved ineffectual partly through neglect of owners to comply strictly with directions regarding the mixing and the strength of the wash used and the period of immersion, and partly as the result of the use of non-poisonous liquid dips, for without a poisonous mixture in some form it is almost impossible to free sheep from lice. A further contributing cause is the deterioration of, at least, a portion of the dipping material—a deterioration probably due to a shortage of some of the chemicals used by the manufacturers, for, until recently, most of the dips on the market have been very reliable.

It would be well if sheep-owners this season noted the result of dipping, and, if necessary, gave their flocks a second immersion before offering any sheep for sale.

Experience has shown that the use of powder, paste, or combination rather than liquid dips is most effective. Many of the manufacturing firms supply powder and liquid material, and give directions for combining them, should this be desired, while others sell a paste which is a combination in itself.

Attention is also drawn to the probability of vermin remaining in flocks, owing to the failure to dip lambs, which are to be kept for some time after the ewes have been dipped. To comply with the terms of the Sheep Dipping Act, lambs, whether shorn or not, should be dipped at the same time as the rest of the flock. Apart from the legal penalties to which sheep-owners render themselves liable for non-observance of this provision, there is the likelihood that such neglect may be the cause of their flocks remaining unclean, for, even though the lambs be dipped later, the eradication of tick and lice has been made very difficult by the growth of wool, and thus vermin may be carried from one shearing to another.

GROWING MAIZE UNDER IRRIGATION.

By H. C. Churches, Dairy Supervisor.

Much has from time to time been written on the advantages of maize growing, both as a fodder crop for dairy cattle, and for grain. That the area—in the irrigated districts—planted with this valuable crop, should be so small, is rather remarkable. Maize growing—even if only on a small scale—could be conducted by every settler on the rich irrigated Murray frontage. It is safe to say that, where land and climate are suitable, there is no other crop that will give the return, either in bulk of fodder or weight of grain, per acre as maize. *The average price of maize per bushel during the past ten years has been 3s. 6d. When the price drops below that figure, it will pay handsomely to feed it to pigs and poultry on the farm. In parts of Queensland, and other places, crushed maize mixed with lucerne chaff forms the chief diet of stable-fed horses. The south-coast (New South Wales) dairy farmers plant their 10 or 15 acres of "corn" every year, the chief object being to obtain a cheap, suitable concentrate for pig feeding with skimmed milk, the corn stalks or "stover" is eaten by the cows—generally the dry ones—during the winter. This practice could with advantage be followed here. It may be mentioned that the average yield per acre in New South Wales is only a little more than half the average Victorian yield. An advantage the irrigator has in growing maize is that most of the work is done in the "off" season. The land is first ploughed in winter, the final preparation, and the planting of the seed, is carried out soon after the first or second "watering periods" in October—that is, before lucerne cutting becomes general. Then, again, harvesting of the cobs is not done until about April—when lucerne cutting and watering is finished for the season. The harvesting of maize, unlike the harvesting of wheat, oats, &c., is not an urgent work, a week or two late being neither here nor there.

Maize growing—although on a small scale—is gradually finding favour on some of the dairy farms in the Swan Hill district, and some nice crops have recently been inspected. A particularly fine crop has been grown this year by Mr. Richard Woodgate, who is more satisfied than ever of the advantages of a paddock of maize for corn each year.

Although the area planted by him is small—being about 1½ acres, and intended chiefly for pig and poultry feed—it clearly demonstrates the suitability of the district for maize production. By measuring and weighing the cobs of corn from one row in the paddock, a yield of about 80 bushels per acre will be obtained. The variety planted is Yellow Moruya. No special care or attention was given the growing crop, other than watering it by the ordinary methods adopted on irrigation farms. About the end of September, the land was watered, and, as soon after as practicable with soil condition, was well worked, and the seed ploughed in and harrowed. No cultivation between the rows was done. An important advantage the irrigator has in maize growing is that the land can be watered, and, as soon after as the condition of the soil will permit, well cultivated to kill all the weeds and prepare a good seed bed, thereby giving the young maize a good start in life, a very important factor in the life of the maize plant.

* See *Journal of Agriculture*, 10th November, 1915, page 676.

THE DAIRY FARMER'S OPPORTUNITY.

By J. S. McFadzean, Senior Dairy Supervisor.

As a body, dairy-farmers are seldom afforded much opportunity of taking definite advantage of economic conditions, and largely benefiting thereby. There are certainly occasions when some may take advantage of local demand, owing to their having stock or produce for sale when the market is favorable, but more often than not it is the general public which benefits at the farmer's expense. At the present time, however, abnormal conditions prevail, and almost every farmer has an opportunity of turning these conditions to his own direct advantage. With the high prices ruling now for all classes of store cattle, every dairyman should clear his place of all inferior stock, and get together a profitable milking herd. A few, maybe, have already commenced to weed out the "duffers," but hundreds have not yet realized their opportunity.

The *Journal of Agriculture*, and possibly every other farmer's paper in this State, has for years been persistently advocating the improvement of all dairy herds by culling. The obstacle to putting this advice into general practice has been that such low prices were usually quoted for cull stock, that, small as might be their dairy yield, it was more per year than their market value. Therefore farmers, while recognising that their stock was of inferior dairy grade, nevertheless preferred to keep them rather than sell at the low figure offering.

This excuse for not selling such cattle has, however, disappeared. No cull cow will return, in dairy produce, anything like her present store value, and prices for all cattle will probably remain abnormally high for some considerable time still. This is the dairy farmer's opportunity. Let the farmer sell his culls *now*, and start building up a herd which will be the foundation of profitable dairy work in the future.

It seems almost incredible that quite recently a dairy farmer, who sells his cream to a factory, was found killing off his young calves, and feeding them to the pigs. Words cannot express such folly, or, perhaps, crime. Had these calves, so foolishly slaughtered, been raised to even four months old, they would have shown, at the very lowest estimate, a profit of £2 per head. In fact, in proportion to labour expended, it would be more profitable to raise the calf than milk the cow for the cream. Further, every calf raised is of so much assistance in the national work of helping out our food supply. The calf-killing farmer is not only wholly unmindful of his duty to the nation as a food-producer, but, from a business point of view, he shows himself to be absolutely lacking in commonsense.

Once again let it be emphasized that, with every prospect of a good grass season, and the abnormal prices obtainable for every class of cattle, the dairyman who does not establish his business soundly now need never expect to succeed. Never before have Victorian dairymen had such an opportunity for unloading their cull stock. How many will avail themselves of it?

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

Cultivation.

Orchard ploughing should now be finished, and the main work for the next few months will be an endeavour to keep the soil surface loose, friable, and well opened. The consolidation of the surfaces must be avoided, as a hard, compact surface means the loss of much soil moisture, by capillary attraction. So that after rains, heavy dews, the spray pump and other traffic, it will be as well to run the harrows over the surface of the soil, so as to keep the surface well broken and to maintain a good earth mulch. If the harrows are not sufficient to break the clods, a spiked or heavy roller should be drawn over it, and then harrowed. If the weather is at all dry it is advisable to plough only as much as may be harrowed in the same day. By immediately following up the ploughing with harrowing a minimum amount of moisture is lost by capillarity.

Green manure crops should now be ploughed under, and should they be very abundant in growth, a roller should be run over them and ploughed with a coulter attached. Any of these means will serve to get the crop underground, which is a desideratum.

In addition to the retention of soil moisture, cultivation of the orchards will suppress the weeds which rob the trees of food and moisture. The suppression of weeds is an important work in the spring and summer, and they should be rigorously hoed or cultivated out.

Spraying.

Spraying for all pests and diseases is, at this time of the year, an important work in the orchard. Bordeaux spraying for the black spot of apples and pears, for scabs and shothole in peaches and apricots, for the leaf curl of the peach and rust of the plums and peaches, should now be completed.

Where there are indications that previous sprayings have not been thoroughly successful, a lime sulphur spray should be given.

Wherever they are present, nicotine sprays should be given to combat the peach aphis, and the pear and cherry slug. For the latter pest, arsenate of lead should not be used if the cherries are within a month of ripening. Arsenate of lead is so tenacious, and thus it is likely to remain on the fruit until it is ripe, when it would be dangerous to the consumer. Thus, while this property of remaining on the fruit for a considerable time is of great value in the Codlin Moth spraying, it is quite of the opposite value when used for the pear and cherry slug. Either tobacco water or hellebore is useful for the eradication of this pest, as these substances do not remain long on the trees, and they are quite as effective as arsenate of lead.

Codlin moth spraying, too, will be in evidence this month. Owing to the early season, it is possible that the development of the moth will take place earlier. It is generally assumed that the appearance of the moth is coincident with the bursting of the flowers. This is not always so—the moths frequently come slightly later than the blooming period. Owing to the rapid expansion of the fruit, it is well to follow the first spraying with a second in a week or ten days' time. Arsenate of lead is still the spray for the Codlin moth, nothing having been found to supersede it.

Vegetable Garden.

A good tilth, and a well-pulverized soil, are the main soil necessities in the vegetable garden this month. Frequent cultivations will keep in the soil moisture, and will obviate the necessity for surface waterings. At the same time, it should be remembered that the vegetable garden requires more water than the flower garden, owing to the quick growth of the plants. Quickly-grown vegetables are more tender and more luscious than slowly-grown ones: thus a good water supply will need to be maintained. Weeds are great moisture-robbers, and they should be kept out of the vegetable garden at this time of the year.

Late plantings of tomatoes may now be carried out; all early-planted plants should be fed, staked, and the laterals pinched back. A little bone-dust or superphosphate may be given, but these are not equal to animal manures, if the latter are available. Chemical manures should only be given in limited quantities, 6 or 7 cwt. per acre would be a heavy dressing, and this works out at nearly 3 ozs. per square yard. Vegetable growers may easily try this for themselves, and it will soon be seen that 3 ozs. scattered over a square yard of surface will appear to be a very light dressing.

French beans, carrot, parsnip, celery, radish, peas, and turnip seeds may now be sown. Seeds of cucumber, melon, and pumpkin family may now be sown in the open ground. All seedlings may be transplanted on favorable days, and it will be well to sprinkle the tops as well as to water the roots.

Asparagus beds may be top-dressed with manure, and kept well weeded. Such weak growths that are not gathered for eating should be cut out of the beds.

Celery trenches will require attention at this time of the year; and to insure good, quick growth, frequent waterings will be necessary.

Flower Garden.

Flower gardens are troubled with many pests at this time of the year. Rose aphis is one of the most prevalent; frequent applications of tobacco water will keep this pest in check. The hot winds should not be waited for so as to rid the garden of the pests, because a great deal of damage is done before the hot winds come. They should be sprayed in any case.

Rose mildew will also need combating. This may be done by dusting the bushes with sulphur while they are wet with the morning dew. The ground may also be sprinkled, as the fumes check the fungus.

Leaf-rolling or leaf-eating insects will need to be sprayed with arsenate of lead or Paris green.

The surface should be kept well hoed so as to conserve the moisture, especially after the frequent waterings that should be given.

Dahlia and chrysanthemums may be planted in soil that has been dug over two or three times, and each time digging in manure. The soil must not be too rich, but must be well drained.

Bulbs that have lost their foliage may be lifted, but do not cut the foliage, as this means loss of sap and energy.

Asters, zinnias, salvias, balsams, amaranthus, celosias, &c., lobelia, bedding begonia, iresines, alternantheras, &c., may now be planted out for summer and autumn flowers.

MANURE FOR ROSES.

In a recent paper on this subject, Mr. W. C. Robertson, Assistant Chemist for Agriculture, recommends the following:—"5 lbs. well-rotted stable manure, 1 oz. bone manure, and 1 oz. dried blood. This to be an annual dressing, apart altogether from the spring and annual mulch. In late autumn give a liberal dressing of lime and ½ oz. of Epsom salts. This treatment is to be applied to each rose bush. If stable manure is hard to obtain, the following dressing is advised:—¼ lb. dried blood mixed with 2 ozs. bone manure per tree, coupled with a dressing of ½ oz. sodium nitrate in the spring. Lime and magnesia as above." The use of Epsom salts as a rose manure is a novelty to the rosarian, but this substance supplies the magnesia which is so much needed by roses.

REMINDERS FOR NOVEMBER.

LIVE STOCK.

Horses.—Continue to feed stable horses well; add a ration of greenstuff. Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses. Feed old and badly conditioned horses liberally. If too fat, mares due to foal should be put on poorer pasture. Turn out workers due for a spell at grass. In view of sand trouble this year horses which have been paddocked all the winter should not be put to work until properly conditioned and any sand accumulation got rid of. A course of three or four bran mashes, after a twelve hours' fast, followed by 1 to 1½ pints of linseed oil, is helpful. Repeat in two or three days, if necessary. Colts to be gelded should be operated on before hot weather sets in

Cattle.—Except on rare occasions, rugs may now be used on cows at night only. Continue giving hay or straw, if possible, to counteract the effect of green grass. Be prepared for milk fever. Read article in *Year-Book of Agriculture*, 1905, page 314. Give calves a dry shed and a good grass run. Continue

giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Feed regularly with regard to quantity and time. Give a cup of limewater in the milk to each calf, also place crushed oats or lucerne hay in a trough so that they can eat at will.

Pigs.—Supply plenty of bedding in well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. Sows suckling young should be well fed to enable them to produce plenty of milk. Give young pigs pollard and skim milk in separate trough as soon as they will take it, and keep them fattening from the start to get them off as early as possible. Give a tablespoonful of bone meal, or half that amount of mineral phosphate, per 100 lbs. live weight in food daily. If pigs are lousy dress them with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect styes. Pig breeding and feeding should be very profitable for a long time to come, and it should be safe to launch out now.

Sheep.—Prepare for dipping. Ascertain exact contents of bath before mixing. Powder or paste dips have the most lasting effect, particularly where the lice have been bad. Hold sheep in the bath not less than half a minute; if badly infested, longer. Submerge heads twice, but allow them to rise quickly—most deaths after dipping are due to gross carelessness in holding sheep under too long, the dip wash being taken in on to the lungs. Dip rams, full grown sheep first, while bath is full, lambs last. Yard sheep over night. Dip while empty, and avoid excessive fouling the drainer. Commence early in the day, and allow sheep to dry before nightfall. Avoid travelling long distances to and from baths, and dipping sheep while overheated. Do not roughly throw sheep in. Avoid filthy baths; this increases a dead tip in hot areas.

When constructing new dips, remember moderate-sized ones are most economical, just as efficient, and can be more easily emptied as they become fouled, and if they are near water can be quickly filled.

Poultry.—Provide plenty of green food and shade. Watch for vermin; spray crevices of perches and houses with crude carbolic acid, 1 in 50. Keep water clean and cool, and out of the sun. One packet of Epsom salts should be given to thirty birds through the mash. Remove all male birds from the flock. Infertile eggs are preferable when pickling, or when placed in cool storage.

CULTIVATION.

Farm.—Plant main crop of potatoes. Cut hay and silage. Weed early potatoes. Sow maize and millets. Weed tobacco beds, and water, if dry.

Orchard.—Ploughing, harrowing, and cultivating to be continued. Weeds to be kept down. Secure, pinch, and spray grafts with water. Spray frequently for codlin moth, pear and cherry slug, and peach aphis. Plant out citrus trees.

Vegetable Garden.—Hoe and mulch surface. Suppress weeds. Water where dry and hoe afterwards. Disbud and pinch back tomato plants. Sow celery, French beans, peas, lettuce, cucumber, melon, &c., seeds.

Flower Garden.—Water and mulch. Cultivate and keep down weeds. Thin out weak wood from roses. Prune early all flowering shrubs that have finished flowering. Lift and store bulbs. Plant out dahlias and chrysanthemums. Liquid-manure herbaceous perennials.

Vineyard.—Field grafts require careful attention in the way of removal of suckers and scion roots. (See articles in last and current issues.) Cultural work, such as scarifying and hoeing, should be actively pushed forward, so as to provide as good a "mulch" as possible during summer. Proceed with tying up, stopping and topping. Avoid excessive topping, summer pruning being usually more injurious than useful in warm, dry climates. Cincture Zante currant vines after flower caps have fallen. Apply second sulphuring just before blossoming, wherever Oidium was prevalent last year.

Cellar.—Same as last month.

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THE COMPOSITION OF THE POTATO PLANT AT VARIOUS STAGES OF DEVELOPMENT.

By J. T. Ramsay, Potato Expert, and W. C. Robertson, Supervising Analyst.

Object of Experiment.

During the past season, 1916-17, an interesting test was carried out to determine, I. the rate of assimilation of food from the soil by the potato plant, and II. the relative proportions of each of the principal elements contained in the plant at various stages of its growth.

How Conducted.

In order to insure the best possible condition for the growth of the crop, together with the maintenance of the greatest facility for the harvesting of all portions of the plant, viz., haulms, tubers, and roots, the crop was grown in a synthetic soil.

This soil was constructed from Carrum sand 13 parts, clay loam surface soil 2 parts, and well-rotted farmyard manure 1 part; the whole when mixed making a choice light sandy loam of a very desirable physical condition.

To guarantee complete harvesting control over the whole of the portions of the plants operated upon, each seed set was planted in a hardwood box 18 inches by 18 inches by 18 inches, containing 130 lbs. of soil —the seed being placed at a depth of 4 inches below the surface. To prevent too rapid evaporation of moisture from these boxes of soil and to maintain an even temperature they were placed in a trench cut in the ground, so that the tops of the boxes were practically level with the surface of the land surrounding.

Care was exercised to insure perfect drainage in order that the plants might be permitted to develop evenly from start to finish of the growing period. To further insure this, water, as required to keep the soil in a

nice condition as regards moisture content, was applied equally to each plant.

Prior to planting, each box was fortified with artificial fertilizers in the following quantities:—Superphosphate, ½ oz.; ammonium sulphate, 1 oz.; dried blood, 1 oz.; potassium sulphate, ½ oz. These were thoroughly incorporated with the soil on the surface of the boxes, and the seed sets (whole) were planted on 17th December, 1916.

The average weight of the sets used was 75 grammes, equalling a shade over 2½ ozs. The variety chosen for the test was Up-to-Date. All of the plants appeared through the ground within three days of each other. This may be considered for all purposes, uniform.

When the plants broke the surface a top dressing of sodium nitrate, at the rate of ¾ oz. per box, was applied.

Analysis of Soil Used.

An analysis of the synthetic soil utilized in this test was made, and is given herewith:—

(Parts per 100,000.)

Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
103	22	82	201	55

For comparison the analysis of an exceptionally good potato soil from the Koroit district is also given:—

(Parts per 100,000.)

Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
468	216	306	2,240	1,108

It will be seen that in actual content of the elements of plant food the synthetic soil used in this experiment compares very unfavorably with the rich potato soil from Koroit, but it should be noted that the availability of the elements in the manufactured soil would be very much greater than is the case with the Koroit land.

Cultural Treatment During Growing Period.

When the plants were well above ground each box was mulched with buffalo grass cuttings, and during the period of growth the surface soil was kept loose, water being applied when necessary. Growth in every case was normal, the plants developing evenly and remaining healthy.

Harvestings.

Harvesting and analysis were done at intervals of approximately one month.

The first harvest was made on 29th January, 1917, being 33 days' growth from date of brairding. The second harvest took place on the 23rd February, 25 days later. The third harvesting was

done on the 26th March, after a period of 31 days from previous harvest, and the fourth and final harvest took place on the 30th April, 35 days subsequent to the third. The total period of maturation for the fully-developed plants was 124 days—roughly, four months. At each harvest considerable care was taken to collect the complete plant, haulms, roots, and tubers, the soil being carefully sifted and hand picked.

In the case of the roots at the fourth harvest, some difficulty was experienced in recovering all of these, on account of their having become dry and brittle, but it is estimated that the loss sustained here would not amount to more than 30 per cent.

At the first three harvests complete recovery was made possible owing to the sandy character of the soil, and the fact that at those stages the roots were alive and tough. Cropping, harvesting, and analysis was done in duplicate in each case, in order to reduce, as much as possible, the margin of error.

An exceptionally heavy crop was obtained in the case of the plants which were allowed to mature, the tubers being of perfect shape and very fine quality.

General.

Remarkably even results were obtained, in duplicate, from each successive harvest.

The results obtained, which are set forth in the succeeding pages, are of considerable value in showing how the plant feeds, the outstanding feature being the evidence, as proven by analysis, of the necessity for an abundance of available food being placed at the disposal of the plant from the earliest period of growth, if heavy yields are to be secured. It was hoped that, as the result of this experiment, some light might be thrown on the reason for immature seed being more productive than ripe seed for the potato crop.

No explanation of this can, however, be constructed from the results obtained, as the composition of the tubers at the first, second, third, and fourth harvests is shown to be practically the same in plant food ratio. It is remarkable that up to the present time no scientific explanation can be produced relative to the phenomenal super efficiency of immature seed, although tests out of number have proven the fact.

RESULTS.

Total Dry Matter in the Plant.

TABLE I.

YIELD PER PLANT AT VARIOUS STAGES OF GROWTH.

Date of Harvest.	Haulm. Grammes of dry matter per plant.	Tubers. Grammes of dry matter per plant.	Roots. Grammes of dry matter per plant.	Total Dry Matter. Grammes per plant.
1st harvest, 29.1.17	49·41	3·44	6·29	59·14
2nd harvest, 23.2.17	158·90	147·10	14·32	320·32
3rd harvest, 26.3.17	219·50	352·35	15·31	587·16
4th harvest, 30.4.17	213·00	423·40	10·70	647·10

Table II.

Yield Dry Matter per Acre at Various Stages of Growth.

—	Haulm.	Tubers.	Roots.	Total Dry Matter.
	tons cwt. qrs. lbs.	tons cwt. qrs. lbs.	tons cwt. qrs. lbs.	tons cwt. qrs. lbs.
1st harvest ..	0 15 2 5	0 1 0 9	0 1 3 25	0 18 2 11
2nd harvest ..	2 10 0 0	2 6 1 4	0 4 2 0	5 0 3 4
3rd harvest ..	3 9 0 7	5 10 3 14	0 4 3 7	9 4 3 0
4th harvest ..	3 7 0 2	6 13 0 25	0 3 1 13	10 3 2 12

Table III.

Approximate Acre Green Weight of Tubers—Calculating 12,000 Plants per Acre.

	Tons.	Cwt.	Qrs.	Lbs.
1st Harvest ..	0	4	0	6
2nd Harvest ..	8	13	2	8
3rd Harvest ..	20	15	3	4
4th Harvest ..	24	18	3	0

The figures in the above tables are of absorbing interest. Apart altogether from the high yield obtained, and this from a soil showing a low content of total plant food, it will be noticed that the plant does not grow evenly over the full period of growth.

Computing from the tables it is found that the root growth during the first month is equal to *41 per cent.* of the total root development, whilst at the end of the second month this percentage is increased to 93, meaning that root development practically ceases at the end of two months.

Computing on the whole plant, approximately *11 per cent.* of the total weight produced during the *first month* is represented by roots. In the *second month* root development amounts to *3½ per cent.* of the total production, whilst, during the *third month*, the root growth amounts to barely *⅓rd of 1 per cent.* of the total plant growth. (Table IV.)

In the case of the haulm the figures show *22.5 per cent.* of the total overhead growth taking place during the first month, and *49.8 per cent.* during the second month—a total of *72.3 per cent.* during the first two months, compared with *93 per cent.* in the case of root growth previously remarked upon.

During the third month, whilst, as in the case of the root, growth diminishes, this decrease is not so marked, for the growth of the haulm during this term is *27.7 per cent.* of the total overhead weight.

Compared with the growth of the whole plant over the given periods, the figures show the haulm growth during the first month to equal *83.5 per cent.* of the total growth, during the second month this figure falls to *42 per cent.*, whilst during the third month the growth of the haulm only produced *23 per cent.* of the total weight produced during the month.

Reviewing the figures given under tubers in Table IV., it is found that less than *1 per cent.* of the ultimate yield was formed during the

Tubers and Roots.

1st Harvest. 2nd Harvest. 3rd Harvest.

first month. The *second month's* growth gave *34 per cent.*; the *th..d month* produced tubers equal to *48 per cent.*, whilst the growth du..ng the *fourth month* gave tubers equal to *17 per cent.* of the total tuber weight.

Computing, as in the case of roots and haulm, on the total growth during the given periods, we find *5.8 per cent.* of the total production during the *first month* to consist of tubers. The *second month* produces tubers equal to *55 per cent.* of the total growth. The *third month* shows an increased weight of tubers equal to *77 per cent.* of the total weight of plant, whilst during the fourth month—the final stage— the *only growth* taking place is that of the tubers.

How the Potato Plant Grows.

TABLE IV.

PERCENTAGE PRODUCTION.

—	Root.	Haulm.	Tuber.
	%	%	%
1st month	11	83·5	5·8
2nd month	3·5	42	55·0
3rd month	·3	23	77·0
4th month	..	..	100·0

(Figures are approximate.)

In the early stages of its life the potato plant practically devotes its whole attention to root and haulm development. In the middle stage it concentrates on the development of haulm and formation of tubers, whilst the final stage shows the dying plant concentrating all its attention on the tuber development—the reproduction of its kind.

Analysis of Seed Set at Time of Harvesting.

At the time of planting an average seed set was reserved for analysis, so far as the essential plant foods were concerned. At each harvest the old seed sets were collected and subsequently analyzed.

As it was impossible to collect the whole of the seed sets in the final harvests, owing to the advanced stage of decomposition, an error is introduced, but the analyses, as set out in the table below, may prove useful for comparative purposes.

TABLE V.

ANALYSIS OF SEED SETS AT VARIOUS HARVESTS.

—	Average Weight Dry Matter.	Nitrogen.		Phosphoric Acid.		Potash.		Lime.	Magnesia
	Grammes.	Per cent.	Weight in grams.	Per cent.	Weight in grams.	Per cent.	Weight in grams.	Per cent.	Per cent
Original set ..	14·95	1·35	·20	·32	·048	2·84	·42	·10	·15
At 1st harvest	12·17	·70	·09	·29	·035	4·13	·50	N.E.	N.E.
At 2nd harvest	9·61	1·52	·12	·28	·027	4·75	·45	N.E.	N.E.
At 3rd harvest	5·80	1·75	·10	·33	·020	1·90	·28	N.E.	N.E.
At 4th harvest	4·70	2·04	·10	·48	·022	5·15	·24	N.E.	N.E.

N.E. = not estimated

A passing glance at Table V. may create a wrong impression, for it will be at once remarked that, in almost every instance, the old decomposed sets show a higher analysis of the essential plant foods than the original set planted, or, rather, the duplicate to the original set planted. The higher percentages in the later harvestings are due to concentration.

The analysis of the set at first harvest is really the most valuable analysis, for this set was well preserved, and further than showing a bad colour and a few cracks it was, to all intents and purposes, a sound potato. All the sets obtained during subsequent harvests were contaminated with sand, and, furthermore, were in an advanced stage of decomposition. In the analyses of the latter the percentages were calculated on the sand-free material.

The weight of the sets necessarily decreased, but apparently whilst the starch and carbohydrates oxidized, the inorganic constituents and nitrogenous compounds remained; although towards the final harvest there is a remarkable decrease in the content of potash, this may have been due to leaching. Computing from the analyses (Table V.), we find apparently *50 per cent. of the nitrogen* and *25 per cent. of the phosphoric acid* contained in the original potato set has been used in the formation of radical and plumule, root and sprout. The potash apparently is not utilized. Probably it is stored in the tuber for the good of mankind in supplying a daily medicine.

The story of seed potato is the direct utilization of the store of nitrogen and phosphoric acid for the formation for the sprout. Approximately half the whole amount of the essentials are used up when the old set commences to decay. The starch is slowly oxidized, but the nitrogen and phosphoric acid excess apparently remains in the seed set. Potash plays no part, or, at any rate, is not directly utilized, *i.e.*, does not enter into the new growth, but towards the final stages of decomposition; a fair amount of this element is dissolved and washed away by soil solution.

The Composition of the Potato Plant at Various Stages of Development.

Table I. shows the weights of dry matter found in the root, haulm, and tubers at various stages of growth. At the various harvests portions of the separate parts of the plant were selected and analyzed.

Similar analyses were conducted by the Ducal Agricultural Experiment Station at Bernberg, in Anhalt (Germany), in 1903-4, the experimenters being the late Professor Dr. H. Wilfarth and Dr. H. Romer.

Their experiment was on a much larger scale than the one forming the basis of this article. Whilst their results coincide to a degree there are certain marked irregularities in the results obtained by them, which did not show in the experiment reported here.

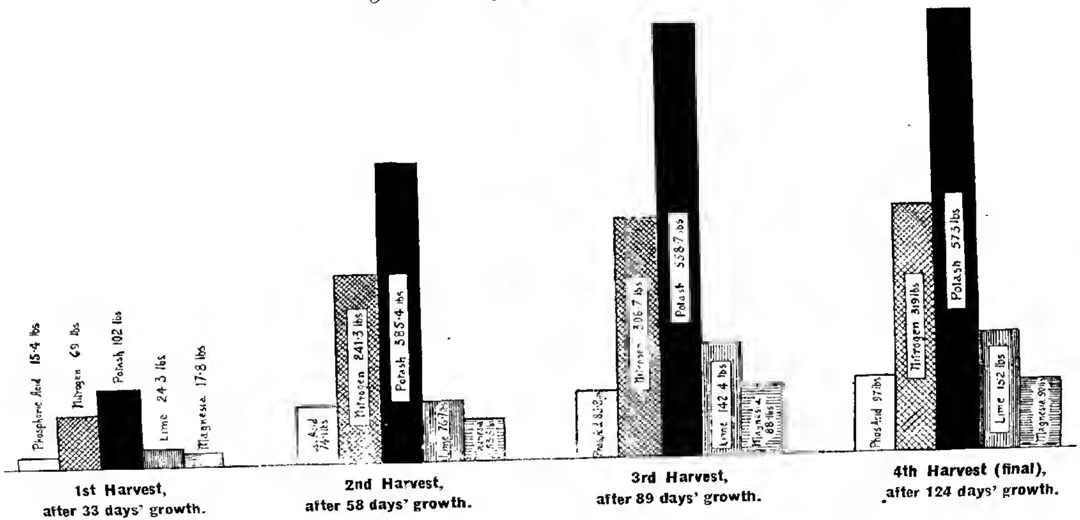
Firstly.—It will be observed on reference to the graph on page 648, that a migration of the essential plant foods from the plant to the soil did not take place. This agrees with the finding of the German expert.

Secondly.—Whilst the essential plant food percentages generally show higher than the German returns, the most marked is the percentages of phosphoric acid. This especially applies to the content in the tubers.

The high content in phosphoric acid of the tubers obtained in the local experiment in the face of the ordinary percentage occurring in the original seed set requires explanation. The only reason advanced is the

The Potato Plant.

Pounds of Nitrogen, Phosphoric Acid, Potash, Lime, and Magnesia utilized per acre (12,000 plants) at various stages of development of a 20-ton crop.



presence of an excess of soluble phosphoric acid in the synthetic soil used in the experiment.

Thirdly.—The small root harvest obtained by the German experimenters compares unfavorably with root figures herein published. (Table I.).

The loose, mellow, coarse sand, used as a soil in the local experiment, was admirably suitable for root harvesting. No information is given as to the soil used by the Germans.

Notwithstanding these unsatisfactory features the experiments agree on the important question, viz.:—Does the potato plant, during its growth, return plant food constituents to the soil? The answer is, No.

TABLE VI.

ANALYSIS OF THE POTATO HAULM AT VARIOUS HARVESTS.

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
	%	%	%	%	%
1st harvest ..	4·82	1·02	7·15	1·69	1·25
2nd harvest ..	3·91	·93	6·23	1·62	1·08
3rd harvest ..	2·47	·36	4·38	2·18	1·16
4th harvest ..	1·99	·33	3·74	2·33	1·14

All percentages calculated on absolute dry matter.

TABLE VII.

AMOUNTS OF PLANT FOODS IN POUNDS PER ACRE, CONTAINED IN HAULM OF 12,000 PLANTS, AT VARIOUS HARVESTS.

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
	lbs.	lbs.	lbs.	lbs.	lbs.
1st harvest ..	62·9	13·3	91·7	22·1	16·3
2nd harvest ..	164·2	39·0	261·7	68·0	45·4
3rd harvest ..	143·3	20·9	265·7	126·5	67·3
4th harvest ..	112·2	18·6	210·9	131·4	64·3

TABLE VIIA.

RATIO OF PLANT FOODS IN HAULM.

—	Phosphoric Acid.	Nitrogen.	Potash.	Lime.	Magnesia.
1st harvest ..	1	4·7	7	1·6	1·2
2nd harvest ..	1	4·2	6·7	1·7	1·1
3rd harvest ..	1	6·8	12·7	6	3·2
4th harvest ..	1	6	11·3	7	3·5

The analyses of the potato haulm at various harvests show a marked diminution (Table VI.) in the content of the three essential plant foods, *i.e.*, nitrogen, phosphoric acid, and potash, from the first to the final harvest. The percentage of lime shows an increase towards maturity,

whilst the percentage of magnesia remains practically constant throughout.

It must not be inferred that a migration of plant food to the soil has occurred. There are two reasons for the decrease in the percentages. In the first place the young and tender plant is always richer in the essentials than the older or coarser plant. This is due to concentration. On the other hand there is a migration of plant food to another part of the plant, viz., the tubers. All the compounds necessary for tuber formation are derived from the laboratory of the plant, viz., the haulm.

A glance at Table VII., giving the amounts of plant foods contained in the haulms of an acre of potatoes (as experimentally grown) throws additional light on the question. The amounts of the bases (potash, lime, and magnesia) increase right through to the end of the third month, and in the case of lime even to the end of the fourth month. The latter fact may be due to the absorption of lime possibly to neutralize the haulm acidity. On the other hand, it will be observed that the amount of nitrogen and phosphoric acid contained in the haulm increases at a great rate until the end of the second month, and then, especially in the case of the latter compound (phosphoric acid), the content shows a remarkable decrease. Apparently these two essentials play an important part in tuber formation and development.

The fact remains, and it furnishes food for thought. Once again nature tells us to help the helpless—as the mother nourishes the suckling babe, so, too, should the potato farmer nourish the crop in the early stages of growth, so that in the presence of a sufficiency of plant food provided by good tilth and liberal manuring, strong, healthy plants containing a rich flow of elaborated sap will greet his eye and, incidentally, fill his pocket.

In a normal season, the critical stage of the potato plant is during the first six or eight weeks' growth.

A word on the plant food ratio of the haulm. The outstanding feature is the two constants. Firstly, the practically constant ratio of the first two months; and, secondly, the practically constant and distinctly different ratio of the final two months.

Apparently, as previously mentioned, the bases (lime and magnesia) are absorbed to neutralize acidity, even after the migration of the phosphoric acid, nitrogen, and, to a lesser extent, of potash from the haulm to the tuber.

There seems to exist a definite ratio between lime and magnesia. This can hardly be by accident, for the soil used was much richer in lime than magnesia.

TABLE VIII.

THE POTATO TUBER—COMPOSITION AT VARIOUS HARVESTS.

—	Nitrogen.	Phosphoric Acid.	Potash	Lime.	Magnesia.
	%	%	%	%	%
1st harvest ..	1·98	·97	4·65	·15	·22
2nd harvest ..	1·79	·82	2·98	·10	·14
3rd harvest ..	1·68	·66	3·08	·11	·19
4th harvest ..	1·80	·69	3·20	·15	·20

Percentages on absolute dry matter.

TABLE IX.

POUNDS OF PLANT FOOD CONTAINED IN THE TUBERS OBTAINED PER ACRE (12,000 PLANTS) AT VARIOUS HARVESTS.

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
	lbs.	lbs.	lbs.	lbs.	lbs.
1st harvest ..	1·8	·9	4·2	·14	·20
2nd harvest ..	69·5	31·9	115·8	3·90	5·40
3rd harvest ..	156·4	61·5	286·9	10·20	17·70
4th harvest ..	201·9	77·4	358·9	16·82	22·40

TABLE IXA.

PLANT FOOD RATIO IN TUBERS.

—	Phosphoric Acid	Nitrogen	Potash.	Lime.	Magnesia.
1st harvest ..	1	2	4·8	·15	·2
2nd harvest ..	1	2·2	3·6	·1	·2
3rd harvest ..	1	2·5	4·6	·2	·3
4th harvest ..	1	2·3	4·0	·2	·3

The foregoing tables, relating to the tuber, are noted for their evenness. After the first month's development the composition of the potato tuber shows a practically constant composition as regards essential plant foods. In the early stage of formation concentration necessarily furnishes a higher analysis. This is most marked in the case of phosphoric acid and potash.

The amounts of plant food per acre (Table IX.), as would be expected show a gradual increase throughout. In this table is seen once again the remarkable relation between the lime and magnesia.

The Ratio Table IXA., excepting the second month's return for potash (which, as in every other case, was obtained in duplicate), is very even, and strongly suggests a distinct relation between the amounts of the various plant foods required for the formation of a given amount of potato tubers.

It will be noticed that the ratio in the tuber is entirely different to the haulm ratio. (Tables VIIA and IXA.)

TABLE X.

THE POTATO ROOTS—COMPOSITION AT VARIOUS HARVESTS.

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
	%	%	%	%	%
1st harvest ..	2·60	·75	3·70	1·30	·76
2nd harvest ..	2·02	·83	2·12	1·27	·66
3rd harvest ..	1·72	·35	1·52	1·40	·73
4th harvest ..	1·88	·40	·82	1·31	·71

TABLE XI.

POUNDS OF PLANT FOOD CONTAINED IN THE ROOTS, CALCULATING 12,000 PLANTS PER ACRE.

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
	lbs.	lbs.	lbs.	lbs.	lbs.
1st harvest ..	4·3	1·2	6·0	2·1	1·25
2nd harvest ..	7·6	3·2	8·0	4·8	2·50
3rd harvest ..	6·0	1·4	6·0	5·7	2·90
4th harvest ..	5·3*	1·1*	2·3*	3·7*	2·00*

* Owing to the advanced state of decomposition, difficulty was experienced in collecting all the roots at the fourth harvest. Apparently the loss was equal to 30 per cent., and this would make the analytical figures obtained from the fourth harvest of the roots practically equal to those of the third harvest.

TABLE XIA.

PLANT FOOD RATIO IN ROOTS.

—	Phosphoric Acid.	Nitrogen.	Potash.	Lime.	Magnesia.
1st harvest ..	1	3·5	5	1·8	1
2nd harvest ..	1	2·4	2·5	1·5	·8
3rd harvest ..	1	5	4·4	4	2
4th harvest ..	1	4·7	2·0	3·3	1·8

The above tables provide additional proof of the function of the plant in exerting its energies during the first two months' growth in the absorption of the essential plant foods from the soil, particular attention being paid to phosphoric acid. It will again be remarked after a study of the tables that a definite ratio exists between the alkaline earths, *i.e.*, lime and magnesia, and this agrees almost exactly with the ratio found in the haulm. (Table VIIA.)

TABLE XII.

COMPOSITION OF WHOLE PLANT AT VARIOUS STAGES OF DEVELOPMENT.

—	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.
	%	%	%	%	%
1st harvest ..	4·42	·99	6·53	1·5	1·10
2nd harvest ..	2·85	·87	4·55	·9	·62
3rd harvest ..	1·97	·54	3·60	·9	·56
4th harvest ..	1·86	·56	3·32	·9	·52

The graph on page 648 shows the amounts of plant foods, including lime and magnesia, which, in this experiment, are calculated to be food for the potato plant required or contained in a potato crop at various stages of development, and which ultimately produced approximately 25 tons of green tubers per acre.

The graph explains itself. Computing on the figures of the fourth diagram it is found that approximately *one-fifth of the total plant food*

entered the plant during *the first month's growth.* During the *second month approximately four-fifths* of the *total requirement* of *phosphoric acid* and *nitrogen* had been acquired, whilst of the total requirement as regards the bases (*potash, lime, and magnesia*) from *one-half to two-thirds* had been acquired at the end of the *second month.* Practically the *whole requirement* of *nitrogen, potash,* and *magnesia* has entered the plant by the end of the *third month,* but the figures show that approximately *10 per cent.* of *the total requirement* in *phosphoric acid and lime* enters the plant after the third month.

Rate of Growth of the Plant.

Computing from Table II. on page 644, it is found that the potato plant produces 9 per cent. of the total dry matter during the *first month's* growth. This increases to approximately *50 per cent.* during the *second month,* and further increases during the *third month* to *91 per cent.* of the *total dry matter* produced. Thus, we have the three cycles in the life of the potato plant. The first is preparation, and it is here that the plant asks for assistance. The second is production. The third is maturation.

Soluble Plant Foods in the Haulm of the Potato Plant at Various Stages of Growth.

The analyses were conducted on the absolutely dry material, the method being to mix 3 grams of the dry pulverized haulm with 300 ccs. of distilled water. The vessel containing the mixture was allowed to remain at a temperature of 17 deg. C. for 17 hours.

The extract was then filtered off and the residue washed with 100 ccs. cold distilled aqua.

The filtrate was evaporated to 300 ccs. and an aliquot taken for the estimation of nitrogen, potash, and phosphoric acid. The usual official method being used in each case.

The results are given in the following table:—

TABLE XIII.

SOLUBLE PLANT FOOD IN THE POTATO HAULM AT VARIOUS STAGES OF DEVELOPMENT.

	Nitrogen.		Phosphoric Acid.		Potash.	
	Per cent. soluble.	Per cent of total in plant.	Per cent. soluble.	Per cent. of total in plant.	Per cent soluble	Per cent. of total in plant.
1st harvest ..	1·55	32	·81	80	7·13	100 (approx.)
2nd harvest ..	·80	20	·67	72	5·34	86 (approx.)
3rd harvest ..	·77	30	·27	75	4·50	100 (approx.)
4th harvest ..	·42	21	·27	80	3·54	100 (approx.)

These figures are interesting in that they show the greatest solubility in the case of potash. The phosphoric acid is apparently mostly soluble, but the greater part of the nitrogen is obviously held in insoluble organic combination. It will be noticed that although the percentages on the dry material show a pronounced decrease in each successive harvest, this decrease is directly proportional to the total amount of plant food present. Therefore the percentage of water-soluble plant food, calculated on the total present, remains fairly constant.

For the purpose of comparison the following table gives the percentage of plant food soluble in water in the case of other crops.

These analyses were conducted on the absolutely overhead dry matter of the matured crop.

TABLE XIV.

SOLUBLE PLANT FOOD IN THE ABOVE GROUND PORTION OF VARIOUS MATURE PLANTS.

—	Nitrogen.		Phosphoric Acid.		Potash.	
	Per cent. soluble.	Per cent. of total in plant.	Per cent. soluble.	Per cent. of total in plant.	Per cent. soluble.	Per cent. of total in plant.
Mustard	·81	70	·51	100	2·54	100
Rye and vetches	·86	50	·60	100	2·76	100
Lucerne	·73	35	·25	50	1·80	90

Excepting lucerne, it is found that practically all the potash and phosphoric acid, as in the case of the potato haulm, is soluble in water. The nitrogen content, although more soluble in the rye, vetches, and mustard, than in lucerne or the potato haulm, is mainly contained in a form insoluble in water.

Whilst the meagre scope of the work done on this question precludes any definite statement the results show a difference in solubility deserving of further work.

The Amount of Plant Food Removed Per Acre by the Potato Plant.

Harvesting, as far as the potato crop is concerned, means the digging, collection, and removal of the potato tubers.

Approximately one-fifth of the total tuber weight per acre equals absolutely dry matter, and approximately one-half of this weight is equivalent to the weight per acre of dried haulms. Organic matter, as is well known, is of paramount importance to the soil, and the partly dried potato haulm is readily broken down in the soil to form humus. Taking a 10-ton potato crop, the amount of absolutely dry matter contained in the tubers is approximately 2 tons. The amount of absolutely dry haulms from this crop would be 1 ton, making a total of 3 tons of dry matter.

Computing from the analysis of the potato haulm (Table VI.), we find that a 10-ton crop of potatoes will return to the soil from the haulms approximately 45 lbs. of nitrogen, 7 lbs. of phosphoric acid, 84 lbs. of potash, 51 lbs. of lime, and 25 lbs. of magnesia to the soil per acre, accompanied or associated with approximately 1 ton of organic matter which, in itself, is of great importance as a soil improver.

Stated in terms of artificial fertilizers, the nitrogen returned per acre by the dried haulm is equal to 2 cwt. of ammonium sulphate. The potash to 1½ cwt. of potash sulphate, and the phosphoric acid (7 lbs.) would be equal to approximately 40 lbs. of superphosphate—all amounting to an appreciable dressing of a complete fertilizer with the additional advantage of supplying the raw material for the formation of humus.

These figures would be supplemented to a small extent when the roots are taken into consideration. On the other hand, a 10-ton potato

crop removes large quantities of plant food from the soil per medium of the collection and removal of the tubers.

As previously stated, the absolute dry weight of tubers in the above crop would be 2 tons.

Calculating from Table VIII. we find 81 lbs. of nitrogen, 31 lbs. of phosphoric acid, and 144 lbs. of potash removed per acre in the form of tubers.

The 81 lbs. of nitrogen is equivalent to a 4-cwt. dressing of ammonium sulphate. The 31 lbs. of phosphoric acid would be contained in 1½ cwt. of superphosphate, whilst 144 lbs. of potash would be supplied by approximately 3 cwt. of potassium sulphate.

These figures represent the actual loss to the soil, and are given with the object of impressing the potato grower with the requirements of the crop, and the necessity of manuring to make good actual loss from the soil by cropping.

Summary.

1. The three essential plant foods, viz., nitrogen, potash, and phosphoric, once absorbed by the potato plant, are utilized, as no migration from the plant to the soil takes place.
2. The critical period of growth is the first six or eight weeks.
3. The greater part of phosphoric acid enters the plant in the early stages of growth, concentrating in the haulm, and then playing an important part by migrating to the stolons for tuber formation.
4. Potash and nitrogen play a consistently even part right through the growing period.
5. Practically the whole of the root development takes place during the first two months.
6. Haulm development is most active during the first two months.
7. The amounts of lime and magnesia assimilated by the potato plant seem to bear a definite relation.
8. The very young potato tuber is richer in phosphoric acid than the semi or mature tuber. (Table VIII.)
9. Phosphoric acid and nitrogen present in the seed set are largely utilized in sprout formation. Potash apparently is not directly utilized. (Table V.)
10. The results of the experiment taken collectively show that manures must be available during the first month.
11. Potatoes can be grown on poor sandy soils, provided that available plant foods in the form of artificial fertilizers, in conjunction with farmyard manure, are judiciously applied, the quantity and quality of the produce being favorably comparable with the best potato soils.
12. The value of the dried haulms and roots may be compared to farmyard manure in favour of the dried haulms, 1 ton of which would supply three times as much nitrogen and phosphoric acid, and approximately ten times the amount of potash as would be contained in 1 ton of farmyard manure.
13. The composition of the potato tuber, under experimental conditions, may be influenced in so far as the phosphoric acid content is concerned.
14. During the growing period the potato plant utilizes phosphoric acid, nitrogen, and potash, in the proportion of 1, 4, 6. *i.e.*, 1 part of phosphoric acid to 4 parts nitrogen to 6 parts potash.

POULTRY AND FRUIT.

A Model Poultry House for the Farm.

1.—INTRODUCTION.

W. Gamble, Principal, Dookie Agricultural College.

At the Agricultural Colleges under the control of the Council of Agricultural Education one of the subjects upon which instruction is given is Poultry Rearing and Management. Information regarding the practical work in the rearing of fowls at the Dookie College will probably be useful, not only to poultry breeders, but also to our agriculturists, for at most country homes fowls are kept in great or small numbers. Even the least observant cannot help noticing the absence of suitable accommodation for poultry on the great majority of farms. Usually they have a free run amongst the buildings, stock, &c., nesting here and there in odd corners and roosting in trees, or, perhaps, an old shed. While such fowls, foraging for their feed and picking up much that would be classed as waste, may be cheaply reared, there is no doubt that they soon deteriorate, and the ultimate result is less productive birds than those raised under better conditions.

With the object of placing this adjunct of the farm on a better footing, the college authorities, after consultation with Mr. Hart, of the Agricultural Department, have laid out a model poultry run suitable for a farm of ordinary size. For this purpose, three-quarters of an acre of land with an easterly aspect and a gentle slope was selected. The house is situated on the high side, in the middle of the top side of the block, thus the full three-quarters of an acre is available as a run. To show that a fowl-run can be made to serve a dual purpose, the enclosure has been planted with assorted fruit trees, which, when they come into bearing, will produce enough to meet the requirements of an average household. In a sheltered nook there are several bee-hives, which are kept with the utilitarian object of supplying honey for the house; but in addition the bees perform useful work in the pollination of the fruit-tree blossoms.

When designing the model, cheapness as well as efficiency was kept in mind, the enclosure being fenced with secondhand wire-netting, and the posts cut from timber in the bush paddocks.

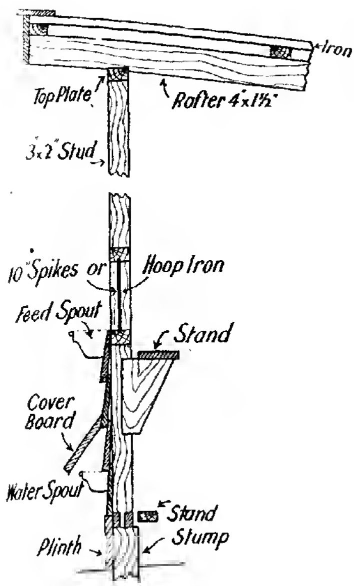
2.—THE BUILDING.

By W. Adams, Building Instructor.

The skillion, or lean-to house, was selected because of its simplicity. There is nothing complicated in its roof or fittings, and probably no design would give more satisfaction to the farmer or small holder.

In selecting a site for a fowl-house, it is always desirable to choose an elevated position, in order to insure good drainage. The building should be well up from the ground, and the use of redgum slabs round the base is recommended, so as to allow filling up inside with gravel or soil, and to confine the litter necessary for scratching purposes.

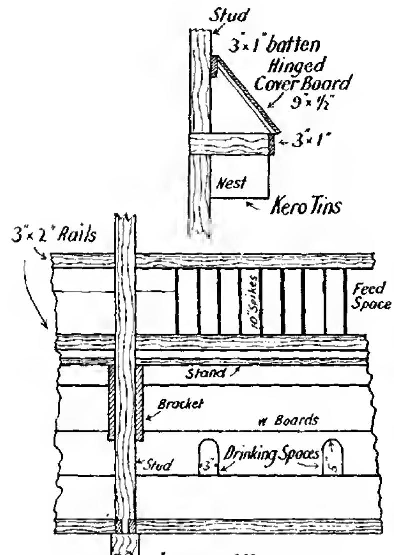
Herewith are specifications for four 10 ft. x 10 ft. pens, with skillion roof and walls 7 ft. x 6 ft. While certain timbers, &c., are mentioned,



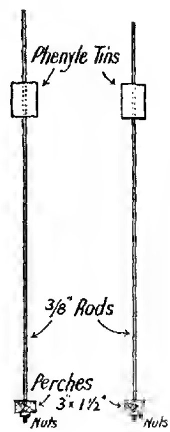
— Section —

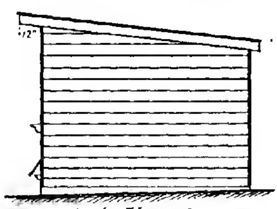
no hard-and-fast rule need be laid down concerning the class of material to be used. If desired, iron could be utilized for the sides and back of the house instead of weatherboards, and by its use the house could be kept freer from vermin than would otherwise be the case. It would no doubt be well to mention here that tongued-and-grooved boards, usually called match lining, are very unsuitable for the sides of poultry houses, as it is impossible to dislodge lice, &c., from this class of timber. The nest boxes, made of kerosene tins with one side cut out, may be easily cleaned, and after collecting the eggs each evening the covers should be let down to prevent the birds from roosting on the edges and fouling the nests.

Stumps ...	Use greybox bush post (if available) of a size equal to 8 in. x 4 in. bearing surface, or redgum 4 in. x 4 in., tarred. Spaced 3 feet centres.
Ground Plates...	3 in. x 3 in. redgum or hardwood, scarfed at all angles and securely fixed to stumps.
Wall Plates ...	3 in. x 2 in. hardwood, scarfed at angles and trenched to receive studs.
Studs ...	3 in. x 2 in. hardwood, housed into wall plates, and spaced not more than 2 ft. 6 in. centres.
Rafters ...	4 in. x 1½ in. hardwood, fixed to top wall plates and spaced, 4-ft. centres, and projecting 1 foot over front of building.
Battens ...	3 in. x. 1½ in. hardwood, nailed to rafters and spaced to suit lengths of iron.
Braces ...	3 in. x 1 in. hardwood, set flush into studs, front surface diagonals to run upwards to top corners.
Plinth ...	9 in. x 1½ in. redgum fixed to bottom wall plate.
Iron ...	26-gauge corrugated iron or suitable lengths to fit roof.
Weatherboards ..	The whole of back wall and both ends to be covered with weatherboards with 1-in. lap.

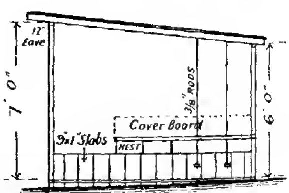


Inside View





End Elevation



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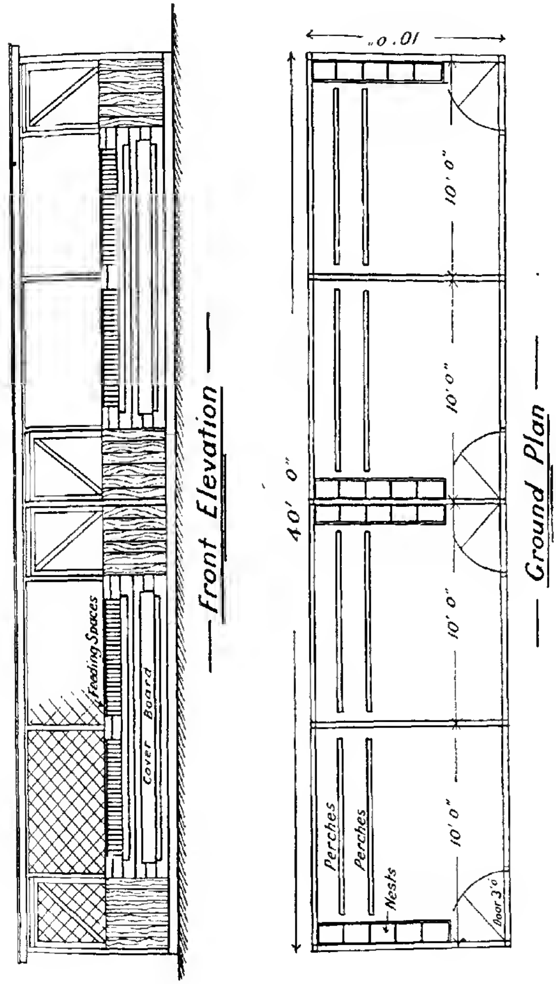

Front Elevation
Feeding Spaces
Cover Board
Ground Plan
10' 0"
40' 0"
10' 0"
10' 0"
10' 0"
10' 0"
Perches
Perches
Nests
Door 3' 0"

Feed Trough ... 6-in. galvanized half-round spouting, the ends of spouting to be left open to allow for cleaning, and fitted with block of wood.

Feeding Rack ... Strips of hoop-iron, about 11 inches long, spaced $2\frac{1}{2}$ inches, or 10-in. spikes.

Water Trough ... $4\frac{1}{2}$-in. O.G. spouting, fixed with brackets and covered with a hinged board to prevent the fouling of water.

Front Wall ... Weatherboarded up to 2 feet high, with holes cut in second board (5 in. x 3 in.) for drinking purposes, and rails let in studs to fix the hoop-iron strips or spikes which form the spaces for feeding purposes: the space above the rails to be covered with $1\frac{1}{2}$-in. mesh wire-netting fixed to studs.

Platform ... On brackets of wood fixed with a board, same height as bottom of feed trough, also lower one similar height as drinking trough.

Partitions ... Boarded up to 2 ft. 6 in. high, then wire-netting up to rafters.

Nests ... Of kerosene tins cut open lengthways and fitted into rails to allow of their being taken out for cleaning.

Covers for Nests Fixed to walls with tee-hinges, made from 9 in. x $\frac{1}{2}$ in. rough lining.

Doors ... Framed and boarded the height of weatherboards and fixed with spring fastener.

Water ... Laid on to trough, either with tap or ball-cock system.

Painting ... Weatherboards to be given one coat creosote and two coats linseed oil, roof to be painted with red oxide.

The following is a list of the material used in building the four-pen fowl-house at the Dookie College, with a statement of its cost. It should perhaps be mentioned that the cost of the items given is that of pre-war times:—

	£ s. d.
Studs—Twenty, 6 ft.; nine, 7 ft.; 3 in. x. 2 in. hardwood ..	4 0 0
Plates—130 ft.; 3 in. x 2 in. hardwood	
Front beam—Two, 20 ft.; 6 in. x. 2 in. hardwood . ..	
Rafters—Eleven, 12 ft.; 4 in. x $1\frac{1}{2}$ in.	
Braces—Four, 12 ft.; 3 in. x. 1 in.	
Battens—170 ft.; 3 in. x $1\frac{1}{2}$ in.	
Rails for feeding rack—Eight, 7 ft.; 3 in. x 2 in.	
Perches—Eight, 9 ft.; 3 in. x $1\frac{1}{2}$ in.	
Weatherboards—750 ft.	3 15 0
Slabs for partition—100 ft.; 9 in. x 1 in. redgum	0 12 0
Iron—Twenty, 7 ft.; twenty, 5 ft.; corrugated galvanized	6 0 0
Nails—3 lbs., 3 in.; 5 lbs., 2 in.; 4 lbs. springheads	0 4 6
Tar—1 gallon	0 2 0
Paint—1 gallon creosote; 2 gallons linseed oil	0 16 0
Hinges	0 4 0
	£15 13 6

3.—HANDLING OF POULTRY.

G. Dowling, Poultry Instructor.

This article has not been prepared for the guidance of poultry farmers, but rather for the instruction of general farmers who keep a flock of fowls to supply eggs for their homes, and, in case of a surplus, for sale locally.

Particularly in our grain-growing areas, where usually there is a great deal of second and third quality wheat, which could be fed to chickens, there is no doubt that the number of fowls raised could be increased considerably, and poultry rearing made a very profitable adjunct to farming.

In the egg-laying competition concluded at Burnley a few months since, 576 birds in twelve months produced eggs to the value of £620. During the currency of this competition times were not normal, and the prices ruling for all classes of feed were high. Everything used in the feeding of the fowls, with the exception of green food, such as lucerne, kale, &c., was purchased, and the profit over cost of feed was 12s. 9d. per bird. It is not to be supposed that the average farmer would be able to get such good returns from his flock at first, but by judicious culling, and the selection of cockerels from the pens of breeders who have demonstrated the value of their stock at the various egg-laying competitions, a great improvement could be effected.

For a number of years at the Dookie Agricultural College various methods of handling and housing flocks of poultry have been tried. The first poultry houses erected were intended for birds entered in egg-laying competitions. The runs were 50 by 25 feet, with a small house standing in the centre of the run. This system entailed too much labour in the collecting of eggs, watering, cleaning, &c., and the houses were eventually moved to one end of the pen, and arrangements made so that all necessary work could be performed from the passages. The average return per bird from small flocks is admittedly higher than that obtained from fowls kept in large flocks, but the initial cost for yards and buildings, and also the consequent additional labour required, makes the "small flock" arrangement impracticable. Another objection to the use of small yards, especially where the plough cannot be brought in, is that in course of a few years they become what is called poultry sick, and quite unsuitable for the rearing of healthy stock. The type of house recommended in this article is designed to accommodate 100 to 120 birds, and one of the two systems may be followed. If the one in use at the college be adopted, and fruit trees planted, the birds need only be allowed out when conditions are suitable. At certain seasons of the year, when the weather is cold and wet, the returns from the birds in such a house are far greater than from birds which have not the advantage of protection from the winds and rain. However, if it is not desired to grow fruit trees, the run in front of the house may be divided into two portions, and one part cultivated while the other is allotted to the fowls.

As it is estimated that each bird drops in a year from 50 to 80 lbs. of manure, it will be easily seen that the land in a very short period of time would become very fertile. Undoubtedly, the most practical way to deal with it is to plough it each year and grow a crop on it.

A suitable morning mash for fowls is composed of three parts by measure of pollard, one of bran, and two of green stuff (chaffed lucerne for preference), mixed up with soup made from table scraps into a fine crumbly condition. Skim milk will make an excellent substitute for the soup. The mash should be fed into a trough made of spouting or of wood. Rabbits boiled and mixed with pollard, &c., will also provide the egg-producing part of what is termed a balanced ration. The evening meal, which should consist of wheat, should be fed into the litter on the floor of the fowl-house. Stable manure makes an excellent litter for the birds, but if this be unobtainable, straw, or even pine needles, will serve the purpose.

Fresh clean water is necessary for fowls, and should be brought to the pens by spouting from a tank at the back or at one side of the fowl-house. Shell grit is an aid to heavy egg production, and an ample supply should be placed in each pen. A kerosene case cut down will make a good grit box. A shallow box filled with ashes and a little sulphur will serve as a dust bath, and will aid the fowls to rid themselves of vermin. A good remedy for lice or poultry ticks is kerosene emulsion, and it is easily made as follows:—Dissolve 1 lb. of common soap in 1 gallon of hot water, add 2 gallons of kerosene, emulsify with garden syringe when spraying, heat up mixture, and then add ten parts of water to one of stock. Use with a spray pump or syringe. Red oil, as used by orchardists, is also excellent for this purpose, and is very easy to make up, no fires being required. Whitewash, as recommended by many poultry writers, is not as effective as spraying.

4.—FEEDING.

H. Simpson, Science Master.

Vegetable and animal products used as food vary greatly in composition. They contain large numbers of chemical substances in varying amounts, but these are grouped together accordingly as they resemble each other in their properties, or according to their values as foods. Thus we get the ordinary divisions of foods into carbohydrates, fats, and proteins or albuminoids. The fats and carbohydrates contain carbon, oxygen, hydrogen; while the proteins contain these in addition to nitrogen, as well as traces of other chemical substances, such as phosphorus. If animal flesh, on the other hand, be analyzed, it is found to consist also of these. As different foods are given to our animals either to build them up, as in beef cattle, or to enable them to give us various products, such as eggs, milk, or wool, it follows that all of these must be manufactured in the body solely from the food which is taken in. The chief function of food is to support bodily activity. This depends entirely on the fact that most chemical substances combine with oxygen, and the substance of each body cell is no exception to this general action, and to this all the activity of life is due. The cell-substance of the body is continuously being changed chemically, by oxygen taken in through the lungs, and thence by the blood stream to these cells. Heat is produced as in any other chemical action, and some of this is changed into motor energy, which is directed into various channels, the remainder serving to keep the body up to a set temperature. But there are other important functions of food; it can be stored up in the animal body

as what we know as putting on flesh; it can be utilized as a building material for a protective covering, as in wool; and it is also used as a supply of food for the offspring. The herbage taken into the body of a cow goes through a long series of processes, and is taken from the teats as a fairly constant material—milk; or, in the case of birds, is stored up as a concentrated food for the young in the protective egg shell Since the functions of food are to fill different requirements, it is obvious that the quantities of the chief constituents with which it should be provided will also vary, and many attempts to determine the amounts of the varying constituents of food to be given under different conditions have been made. The various foodstuffs—protein, fats, and carbohydrates—differ in their physiological value; proteins serving as the greatest muscle builders, fats and carbohydrates as heat producers. Hence it is necessary, in order to cater for all bodily wants, to have the amounts of each given in a proper proportion; the results of this is "the balanced ration." This can be worked out as the following fraction:—

$$\frac{\text{Albuminoids.}}{\text{Carbohydrates} + (\text{fats} \times 2\tfrac{1}{4}).}$$

The ratio thus obtained must not be allowed to fall outside certain limits. Thus—

$\frac{1}{2\text{-}4}$ is a narrow ration, or one rich in protein.

$\frac{1}{5\text{-}6}$ is medium.

$\frac{1}{8\text{-}12}$ a wide ration, or one poorer in protein.

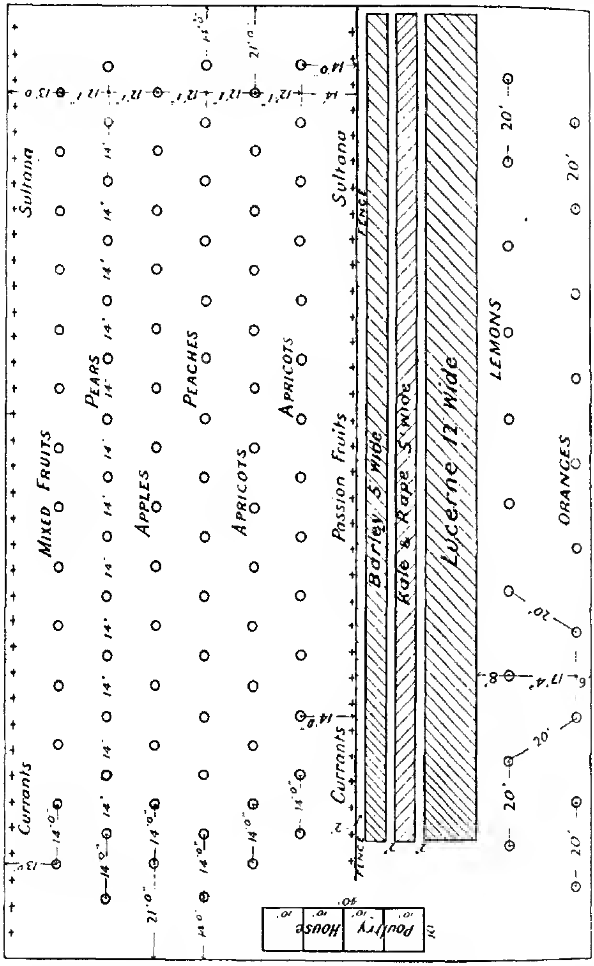
These limits must be observed, as a ration which is too narrow entails too much work on the organs of the body, while one which is too wide does not give sufficient building material to replace body waste. On the other hand, in animals and birds from which we desire natural products, as milk and eggs, the ration must be narrow, as the food must serve its double function—sustaining the body and supplying material for the sustenance of the offspring.

5.—PLANTING THE ORCHARD.

H. J. Rorill, Horticulturist.

The value of the poultry yard can be further enhanced by planting it with fruit trees and vines, which in hot weather will give shade for the fowls. The cost of such a plantation would not be great. The land should be ploughed and sub-soiled to a depth of at least 14 inches, and after harrowing is ready for planting. The sub-soiling breaks up any hard soil below the surface, and allows the roots of the trees to penetrate deeply. Trees should be planted 24 feet apart on the septuple, and the base pegs for this distance should be 20 ft. 9½ in. apart. How large should the hole be? He was a wise fruit-grower who, when asked this question, replied, "As large as the field." In digging the holes, the surface soil should always be thrown on one side and the lower on the other, so that when the tree is planted the surface earth may be placed in direct contact with the roots and the lower soil used to fill

up the hole. The roots should be carefully spread out, and care taken to see that none of them is twisted, before the soil is placed around the tree. Any large roots should be cut back with a fresh clean cut, and all bruised roots must be cut back to a sound place, and efforts should



Plan of Orchard and Poultry Run at Dookie Agricultural College.

be made to plant all the trees at the same depth they occupied in the nursery row.

At the college a hedge of olives has been planted along the southern fence, and 24 feet from the hedge there are two rows of citrus, the first

consisting of twelve Washington navel oranges, and the second of ten Lisbon lemons and two Seville oranges. These trees are planted 20 feet apart on the septuple (base pegs for this distance should be 17 ft. 4 in.); a strip of lucerne then runs the length of the plot, and the division fence is planted with currants and sultanas, the fence wire being used as a trellis. The remainder of the plot is taken up with six rows of fruit trees planted 16 feet apart on the septuple (base pegs for this distance should be 13 ft. 10½ in.). They are—1st row—apricots, "Moorparks"; 2nd row—apricots, "Royal" and "Hemskirke"; 3rd row—peaches, "Elberta" and "Early Crawford"; 4th row—apples, "Jonathan," "London Pippin," and "Rome Beauty"; 5th row—pears, "Williams," "La Conte," and "Glou Marceau"; 6th row—mixed fruits, consisting of prunes, figs, greengage, nectarine, Japanese plums—in all, 24 citrus trees and 72 deciduous trees. The northern fence is also planted with currants and sultanas. The cost of the trees was as under—

	£	s.	d.
24 citrus (balled), at 3s.	3	12	0
72 deciduous, at 1s.	3	12	0
	£7	4	0

It should be mentioned that the trees in the poultry yard at the Dookie College were planted for purposes of instruction rather than with a view to good fruit returns, but in a farmer's fowl-run they should be not less than 24 feet apart.

One of the most recent discoveries of the Pasteur Institute of Paris has to do with stimulating qualities of milk. While milk has always been considered an excellent tonic, and known to be exceptionally rich in food value, it was not until the Pasteur Institute conducted a number of conclusive experiments, that the stimulus in milk became a known quantity. For a number of months, milk has been given the French soldiers in the trenches, and to many of them it has been the one and only stimulant. The effect which the milk has produced has more than justified the claims which the Institute made for it.

It is claimed that the stimulating effect of milk is especially notable when given to soldiers just before a big battle or a dangerous charge, and also when administered to the troops when in great fatigue. The advantage of the milk stimulus over the alcohol stimulus so extensively advocated in previous years is that there is no bad after effects, and the keenness of the senses is in no wise impaired nor the coolness of judgment affected.

The knowledge that milk is a stimulant of no mean force will come as something of a shock to those who have hitherto considered it synonymous with all things mild and peaceful. It is somewhat difficult to believe that the chief product of the patient and gentle cow should contain such an element of forceful stimulation. But, as proof of the contention, we have the word of the world's greatest research institutes, backed up by conclusive experiments in a place where stimulation of the most efficient sort is needed.—*Producers' Review*, 10/4/17.

FARMERS' FIELD DAY AT WERRIBEE.

Despite unsettled weather conditions, and the counter attraction of the Melbourne Show, the special train that left Melbourne for the Central Research Farm, Werribee, on 28th September, was packed with farmers and others interested in the experimental work carried on there.

Though this annual visit of inspection was a complete success at its inception in 1913, each year has witnessed a constantly increasing number of visitors making the pilgrimage to Werribee on the Field Day.

Among those present were His Excellency the Governor (Sir Arthur Stanley), the Minister for Agriculture (Hon. F. Hagelthorn, M.L.C.), the Minister for Lands (Hon. W. Hutchinson, M.L.A.), many representatives of the Federal and State Parliaments, and upwards of 500 visitors.

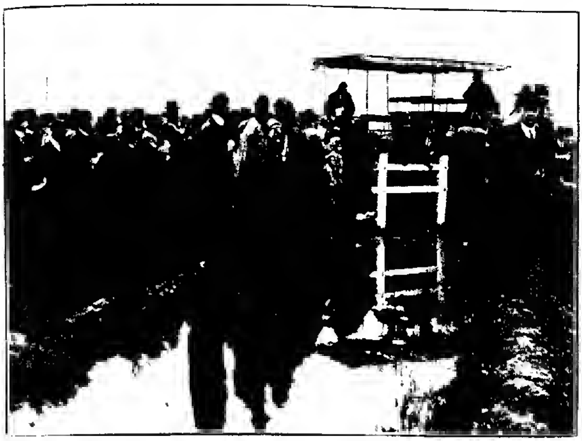
The purpose of the visit is to bring farmers into closer touch with the Research Farm, where much of the experimental work undertaken by the Department is being conducted, and to give them an opportunity of gaining first hand information of the latest results. Of course, it is recognised that a mere visit of half a day is all too short to make much more than a cursory examination, but a guide book is published giving a complete account of the work undertaken, and the trend of the results, so that the visitor is able to digest at his leisure the information obtained at the farm.

Arriving at Werribee, the visitors were met with numerous conveyances, many of which were kindly provided by local farmers. A short drive brought the farm into view, and its appearance, despite the previous dry conditions experienced, was excellent. The farm gates are about a mile from the station. Here the crowd soon assumed considerable proportions. The visitors were welcomed at the main entrance by the Minister for Agriculture (Hon. F. W. Hagelthorn, M.L.C.) and the Director of Agriculture (Dr. S. S. Cameron). Dr. Cameron briefly outlined the objects of the farm, and indicated the character of the work in progress.

Headed by Mr. Richardson, the Agricultural Superintendent, the crowd moved off to that portion of the farm devoted to the testing of various types of rotation farming. The neat and orderly arrangement of the plots, and their workmanlike appearance, was very striking, and the visitors listened with attention to a discussion of the results that have been obtained. Particularly interesting was a comparison afforded by the difference between the growth of the crop on the oaten hay continuously plot and that on the oaten hay after bare fallow plot. The growth in the latter case was more than double that on the former. The relative merits and returns obtained by a number of other systems of rotation were discussed, and numerous pertinent questions answered.

The irrigation field was next visited, and the mode of watering was demonstrated. Discussion of many practical problems followed. On the farm there are some 260 acres under irrigation, including 160 under lucerne, so that many of the visitors who were specially interested in this phase of agriculture found plenty to occupy their attention. This area comprises both a bulk area and experimental plots; but it was this latter portion, which includes tests with various manures, variety trials, and rates of seeding tests, that especially interested many; judging by the remarks, the manuring of lucerne was apparently a new

thing to some. Visitors noted the profitable results obtained with dressings of 1 to 2 cwt. superphosphate on irrigated lucerne, and the demonstrator, in explaining these results, drew attention to the enor-



Lecturette in the Lucerne Field.

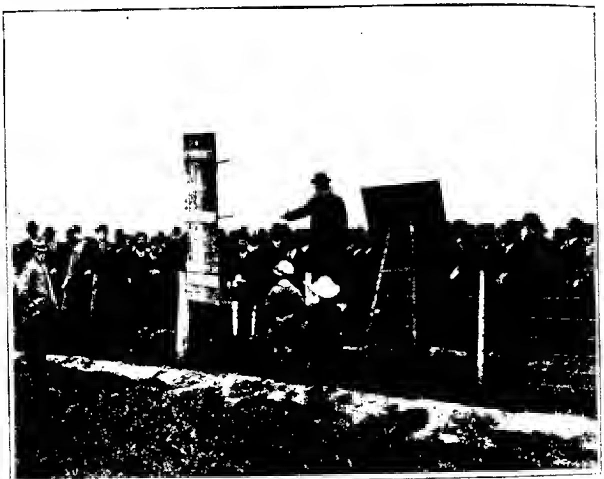
Mr. Richardson explaining Results of Selection as applied to Wheat.

mous foraging power of lucerne, and said that it had been proved by experiments on the farm that during a space of two years an average lucerne crop took from the soil enough phosphoric acid to supply the

needs of five 30-bushel wheat crops. This showed why it responded to phosphates.

One of the main activities of the farm is the production of new varieties of wheat by cross breeding. This is a type of work which never fails to fascinate the average farmer. In the stud plots of the farm many thousands of new varieties were to be seen in all stages of the lengthy process necessary to fix them as true to type. When fixed, the lecturer explained, they are grown in competition with standard varieties, such as Federation; but it is necessary for them to successfully graduate on the plots and in the bulk fields before they are issued to farmers. Visitors viewed several promising new varieties which are undergoing final trials.

The manurial trials sown to wheat were next visited; here the profitable returns to be obtained from dressings of superphosphate



Mr. Richardson explaining Factors involved in Cross Breeding of Wheat and Barley.

heavier than those usually applied were stressed. The lecturer laid emphasis on the difficulty of judging the effect of small but profitable differences in the yield due to manurial application, and he urged farmers, if doubtful when trying heavier dressings, to always put the results to the test with the harvester. He illustrated his remarks by reference to the plots in front of the farmers.

The visitors at this stage were taken in hand by the Director of Agriculture, Dr. Cameron, who from a vantage point introduced his audience to a magnificent herd of Red Polled cows grazing on a stand of irrigated mixed grasses. These animals, hornless and all of an extremely even colour—a rich, deep red—looked perfection indeed, and Dr. Cameron had no difficulty in convincing every one present of their great dual-purpose qualities. He outlined the history of this herd, which, he said, has been built up from a nucleus of twelve heifers and one cow

in 1909 by natural increase, local purchase, and importation. He stressed the importance of performance at the milking pail in building up a dairy herd, and said that the Department had in its possession the milking and butter fat records of every cow that had ever passed through this herd, and had rigorously culled on that test.

The effect of that was shown by the prominent place this Red Polled herd occupied in the Government herd-testing competitions. Just at this time a big-framed cow, with the stamp of deep-milking qualities writ large upon her, strolled into a prominent position just in front of the speaker. "That," he said, "is Muria, who in 1915-16 produced no less than 881 pounds of butter fat in 365 days. In that year, in respect to butter fat production, she was the champion cow of any breed in Australia, and the champion Red Polled in the world. She was given no extra pampering. This year, notwithstanding that she had had milk fever, she had produced 600 lbs. of butter fat." Numerous questions

Portion of the Red Poll Herd.

were put to the speaker, especially as to the performance of this cow, the feeding of the herd generally, and the price of the young stock.

The visitors were next conducted to the farm buildings proper, where the practical efficiency of the design of the buildings and their general lay-out excited favorable comment. Visits were paid to the dairy and milking shed, and the stables, while admirers of horses found much to interest them in a display of brood mares and the horse "Major Oates."

After afternoon tea had been served in the large hayshed, opportunity was taken by His Excellency the State Governor, the Hon. the Minister for Agriculture, Mr. Swinburne (Inter-State Commissioner), and a number of other distinguished visitors, to speak in terms of unqualified approval of what they had seen. The dominant note of most speeches was the need for the awakening of public interest in research work in agriculture, and the need for patience in awaiting results.

Sir Arthur Stanley congratulated Dr. Cameron on the excellent work done by the Department of Agriculture at the State Research Farm.

Such comprehensive experiments in progress at the Farm were needed to enable the agriculture of the State to be progressive. He had thoroughly enjoyed the two hours' tramp round the experimental fields.

Mr. G. Swinburne, Inter-State Commissioner, in moving a vote of thanks to the officers of the Department, said he was astonished to learn that the net cost of the Research Farm to the State was only about £2,000 per annum. Even if it cost ten times that amount, the cost would be small in comparison with the benefits gained. In Australia there were great possibilities in the application of scientific knowledge to agricultural pursuits. He urged the farmers not to cavil at any expenditure by the Government on research experimental work, but rather to demand an increase in the amount voted, for the results of such work would be of inestimable value to the State.

A Group of Visitors.

Reading from left to right—Dr. Cameron, Hon. W. Hutchinson (Minister of Lands), ——————, Mr. H. J. M. Campbell, M.L.A., Mr. S. Hutchinson, His Excellency the Governor (Sir Arthur Stanley), Mr. S. Sampson, M.H.R.

Mr. Rodgers, M.H.R., introduced the audience to a new branch of activity on the farm—that of the training of returned soldiers in general farm and irrigation work. He drew the attention of the visitors to a fine new building erected for housing these men, and made a stirring appeal for a donation towards the provision of a piano for the evening recreation of the soldiers. In a manner that was nothing short of masterly, he succeeded in raising £30 in a few minutes. (With this sum, together with that previously subscribed by the officers of the Department, a fine piano has since been bought.)

Shortly afterwards the drags assembled and carried the visitors back to the station. Judging by the large attendance, the enthusiasm displayed, and the letters of appreciation since received, it is evident that Farmers' Field Day at Werribee has become one of the most useful and informative institutions of Show Week.

EVAPORATION OF APPLES.*

By J. S. Caldwell, Fruit By-Products Specialist, State College of Washington Agricultural Experiment Station.

(Continued from page 607.)

Heating Apparatus.

Unfortunately there is at present no furnace on the market which can be recommended for use in evaporators. The "hop stoves" generally used in hop kilns are of good size, but are too light in construction to stand the continuous firing at utmost capacity for periods of 40 to 60 days necessary in an apple kiln. The large cast iron furnace weighing 1,500 to 2,000 lbs. each, universally used in Eastern evaporators, are especially designed for burning hard coal. Soft coal cannot be used in such a furnace, as the pipes promptly become clogged, while the opening of the door in firing permits the escape of dense clouds of smoke and soot, covering the fruit with black flecks, which completely ruin it. Since the prices of hard coal entirely prohibit its use, furnaces of the prevailing types in use in the East are not available to the North-western evaporator, who is restricted to wood as the only fuel which he can successfully and economically use in his kilns.

One or two makers of evaporator machinery make heavy, durable cast iron furnaces, intended to be fired with wood, and these are in successful use in some sections of the United States and Canada. All such furnaces with which the writer is acquainted, however, have the serious defect that the fire-boxes are at most 36 to 42 inches in length, and not more than 12 inches in height, while the door is usually 10 x 10 inches. Four-foot cord wood must be cut in two, and the larger pieces split, which entails considerable expense, while the fire-box cannot be properly filled with the resulting 2-foot lengths. Consequently, the fires demand constant attention, and the temperatures produced fluctuate considerably. If some foundry centrally located in the North-west would put upon the market a heavy, well made, durable wood-burning furnace, having a fire-box long enough to take 4-ft. wood, and at least 24 inches in width, with doors 20 x 24 inches, it would find general favour. Cord wood could be used as it comes from the forest, and it would be relatively easy to maintain a constant temperature with a minimum of attention. It is hoped that such a furnace may soon be placed on the market.

The most satisfactory source of heat is a well built brick or stone furnace, properly lined with the best quality of fire brick. Such a furnace should be at least 4 feet wide, and deep enough to take wood in 8-ft. lengths of any size that one man can readily handle. If the walls are properly laid with a good quality of mortar, such a furnace is practically everlasting, except that the fire brick lining will need repairs and partial replacement every second season, while the first sections of pipe will scarcely stand more than one year's use.

The piping of the furnace is extremely important, since the operator must depend upon the arrangement of his pipes both for utilization of the heat produced and for its uniform distribution to the drying floor.

* Reprinted from a Bulletin issued by the State College of Washington Agricultural Experiment Station.

Several systems of piping are in use, each with a number of strong advocates, but all are alike in that they use in an 18 x 18 or 20 x 20 foot kiln, 175 to 250 feet of 8 or 10 inch pipe, disposed in a series of loops or coils beneath the kiln floor. The description which follows, if studied in connexion with the diagrammatic sketches (Fig. XVI., A, B, C,) will make the method of arrangement clear. The "single pipe system," in which the piping makes one circuit about the room, is used where the location of the building or the construction of the flues makes it impossible to secure an ample draught. The "double pipe system," in which the pipe, after being carried around the walls, is brought back across the floor before it passes into the flue, is used in kilns of large size or wherever ample draught can be secured. The double pipe system is preferable, since more of the heat is utilized, and its better distribution to the floors results in more uniform drying than can be secured by the single system.

No matter what system of piping may be adopted, connexion with the furnace collar is made by means of a section of special double thickness Russia iron pipe, 10 inches in diameter. This is fitted with a T joint, the whole standing erect and rising to about 4½ feet below the kiln

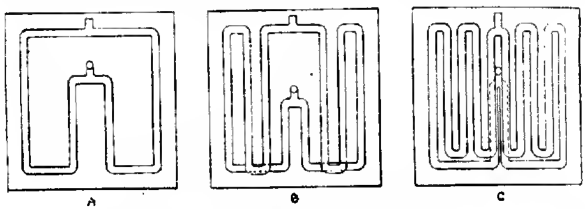


Fig. XVI.—Systems of Piping which Increase Efficiency of Furnace.

A., single-pipe system, used in small kilns, or when jacket-and-hopper construction is employed. B., double-pipe system, employed in large kilns or tunnels. C., a still more efficient double-pipe system.

floor. To the T, elbows are fitted, and two parallel lines of pipe 10 inches in diameter are led from these across the room to a point directly opposite the chimney, and about 22 inches from the wall. These pipes are given such an inclination as will bring them at this point to within 3½ feet of the kiln floor; a nearer approach would be dangerous, because of the high temperature of the pipes. At this point elbows are fitted on, and the two pipes are carried in opposite directions around the walls of the room to the flue. In case the "single pipe system" is used, these lines may be given sufficient upward inclination to bring them to within 24 to 30 inches of the floor at the flue, where the two pipes are united by means of a T joint fitted with dampers, which enters the flue (Figure XVI., A). If the double pipe system is to be used, the rise given the pipe to this point must be more gradual, and the two lines, instead of being united, are carried back and forth across the room in one of the methods indicated in the diagrams (Figure XVI., B, C), with such upward inclination as will bring them to the flue not less than 20 to 24 inches from the kiln floor. In the double pipe system, 10-in. or 9-in. pipe

is generally used for the first circuit of the walls, while 8-in. pipe may be used for the remainder of the system. Wires, or light chains, are used to suspend the pipe from the joists of the kiln floor.

In order to prevent overheating of the area immediately above the furnace, a deflector is employed. This may be simply a sheet of iron having the same dimensious as the furnace and spiked to the lower edge of the joists. A better plan is to cut and fold the edges of the sheet so as to give it the form of a low, flat inverted hopper, and to suspend it by means of chains, so that it may be raised or lowered with the changes in the temperature at which the kiln is being operated.

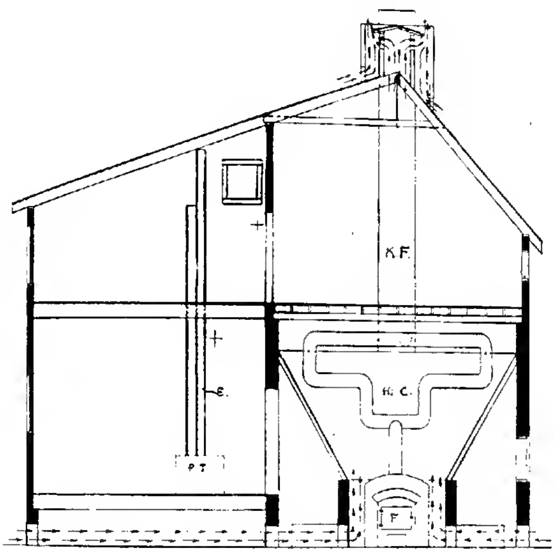


Fig. XVII.—Sectional End View of Building, showing Jacket-and-Hopper Construction.

F., furnace, enclosed by jacketing wall, upon which base of hopper rests. H.C., coils of piping. K.F., kiln flue. Paring table and elevators for apples and waste, position of bleacher, and location of shafting are also indicated, as is the construction of the ventilator.

The efficiency of the furnace may be very considerably increased, and the expense of piping materially reduced, by the adoption of the "jacket-and-hopper" plan of construction in the furnace rooms. In this plan of construction the furnace is enclosed, at a distance of 12 or 18 inches from its walls, by a wall of stone, brick, or concrete, which rises to a height of about 6 feet, thus forming a rectangular box inside which the furnace stands. Each wall of this structure has at its middle an opening, 3 feet in length by 18 inches in height, placed 6 inches above the floor level, and at the front of the furnace, there is a large sheet iron door

through which the furnace tender enters. Upon the "jacket" thus formed, the "hopper" is built by constructing a frame of 2 x 4 scantling extending from the top of the jacket wall outward and upward to the wall of the room just below the kiln floor. Upon the frame thus made, perforated metal lath is nailed, and the "hopper" is completed by covering the lath with a ⅜ or ½ inch layer of cement. The furnace thus stands at the bottom of a shallow, flaring hopper, which is roofed by the kiln floor, with a current of air entering through the ventilators of the jacket, becoming warmed as it passes over the furnace, and rising through the floor above. (See diagram, Fig. XVIII.) This arrange-

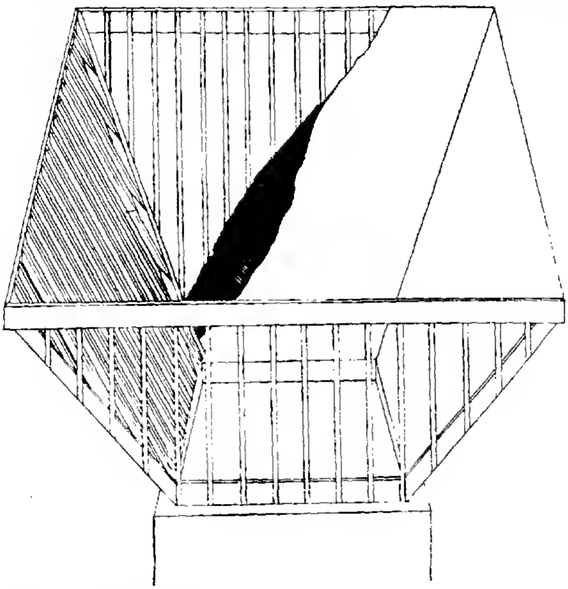


Fig. XVIII.—Detail of Jacket-and-Hopper Construction. Detail of framing of hopper shown on left hand side and front, framing covered by metal lath with cement partially in place at back.

ment reduces loss of heat by lateral radiation to a minimum, gives more uniform distribution of the heat to all parts of the kiln floor, and permits the use of the single pipe system with satisfactory results. Some operators claim that the efficiency of their plants is increased 25 per cent. by the adoption of this arrangement, since the time required for drying is materially shortened, even when the floors are more heavily loaded with fruit.

The chimney should be built in the common wall between two kilns. It should rest upon a solid stone or concrete column extending up to within 18 inches of the point of entrance of the flues. There should be

no air openings into the chimney below the flues, as they will increase the consumption of fuel, and cause trouble in other ways. The chimney should be 16 inches square if two flues open into it. Many operators insist that better results are obtained if the chimney is made double all the way up, each opening being 10 x 12 or 12 x 12 inches, but the writer has seen so many plants with two kilns piped into a single 16 x 16 flue that he thinks a separate flue for each pipe entirely unnecessary. The chimney should extend far enough above the roof to insure good draught and to prevent damage to fruit by the blowing of smoke and soot down the ventilators on windy days.

The Kiln Floor.

The kiln floor is constructed of wooden strips, or slats, usually ⅞ or 1 inch square, but beveled on two sides, so that one face is ½ inch wide. These are nailed to the joists, narrow face down, and are spaced ¼ or ⅜ inch apart. There are thus left narrow openings through which the warm air rises, and as the beveling of the slats makes these openings wider below than above, they cannot become clogged by particles falling through. In the Eastern evaporators, kiln slats are made of basswood, maple, beech, or poplar, and many makers and dealers in evaporating machinery carry such slats in stock. Any hard wood which does not impart flavour to the fruit or warp badly can be used, but fir or other coniferous wood is worse than useless, as the constant high temperature will bring out the resin and give the fruit a persistent odour and flavour which ruins it.

After the kiln floor is in place, it is oiled a few times at intervals of two or three days with lard oil, paraffin oil, or a mixture of boiled linseed oil and tallow, applied very hot, in order to thoroughly saturate the slats. This prevents sticking of the fruit. After the kiln is in use, one or two oilings each season will keep the floor in good condition, but it should be thoroughly scrubbed with strong, hot soapsuds at least once, preferably twice, each week during the season.

Steam-heated Kilns.

Kilns in which the heat was furnished by coils of steam pipe placed beneath the drying floor were at one time rather widely used in western New York, but have in recent years become extremely rare. The writer examined two plants of this type with considerable care, in the belief that this method of heating has decided advantages in regions which are restricted to soft coal or wood as fuel. Unfortunately it was impossible to find in western New York a steam plant of any considerable size, or one in which modern business methods were employed. The plants seen were small, had been built, and were operated largely or wholly, by the owners and their families, and absolutely no records of cost of building materials or of construction had been kept, while such data as to cost of operation as could be secured were merely crude estimates. Such data are of little value, and are rendered less valuable by the extremely unsystematic, unbusiness-like methods which were in use in both plants, but it indicates that the cost of construction was about 10 per cent. greater than in ordinary kilns of equal capacity in the same locality, while the operating costs were practically the same.

A steam plant located near North Chili, New York, had two 16 x 16 foot drying floors, with a total capacity of 150 bushels per day. The drying floor was placed 3 feet above the ground level, so that the building was only 10 feet in height at the eaves. From the boiler two main feed pipes were led off, one to each of the drying floors. One-inch pipe was used for the heating coils, which were placed 12 inches beneath the drying floors. Each heating coil opened directly out of the main feed pipe, and consisted of three 16-foot lengths of pipe, connected by elbow unions, so that they passed three times across the floor, 4 inches apart, before entering the return pipe. Each 16-foot floor had sixteen such coils, each 49 feet in length, inclusive of elbows and unions, or a total length of 784 feet of 1-in. pipe for 256 square feet of drying floor in each kiln. The ten-horse-power boiler supplied power for running parers, as well as for operating a series of fans which forced the warm air through the fruit, and when the boiler was run at 50 lbs. pressure the drying of apples spread in a 5-inch layer occupied about eighteen hours when the fans were not used, thirteen to fourteen hours when they were operated.

Despite the fact that evaporation by steam has been abandoned in regions having abundant supplies of cheap hard coal, the method has certain advantages which, in the writer's opinion, make it desirable that it be experimented with in the north-west. Briefly stated, these advantages are—

1. The expense of construction of the evaporator building may be much less, since the building need be only 10-12 feet in height, while the fact that danger from fire is negligible permits the use of wood construction.

2. The cheaper grades of soft coal or slack may be used in regions where wood is scarce or expensive, and the labour of firing is much less than in a kiln of corresponding capacity.

3. It is much easier to maintain any desired constant temperature with steam than with direct radiation, since automatic regulators can easily be installed. Consequently it is possible to improve the quality of the product and to shorten the time spent in drying.

Over against these advantages must be set the disadvantages, namely, that the initial expense of purchase and installation of steam piping is considerable, while the deterioration of such pipe is rather rapid, while a steam boiler will usually be useful for no other purpose, hence constitutes a charge of considerable magnitude against the plant.

Taken altogether, the advantages of absolute control of temperature during the drying process and of being able to use any sort of fuel make the method one which has considerable promise of value, and the writer believes that, despite the very large number of unsuccessful methods of drying by steam which have been devised in the past, successful and economical methods may yet be worked out. Such methods will be developed, however, by the application of steam to other types of evaporators than the kiln. The use of successive tiers of trays, each heated by coils of pipe placed beneath, with fans to control the circulation of air, will give large drying capacity in a relatively small compass, and will permit less expensive construction, since the danger of fire will be practically absent. Several plants which employ stacks of trays heated

by coils are in course of construction in the North-west, but none of them have been subjected to the test of practical use in competition with other methods of drying for a sufficient length of time to enable one to say whether any of them will be commercially successful.

The Tunnel Evaporator.

The need of the prune-growing districts of the North-west for an efficient and economical method of drying prunes led to the development, in the early nineties, of a great variety of evaporating machines. In a publication, entitled *Prunes in Oregon,* issued as Bulletin 45 of the Oregon Agricultural Experiment Station in June, 1897, Professor U. P. Hedrick, at that time horticulturist of the Oregon Station, described seven types of prune evaporators, each known by the name of its manufacturer or patentee, then in use. Two years later, J. A. Balmer, horticulturist of the Washington Agricultural Experiment Station (*Prunes,* Bulletin 38, Washington Agricultural Experiment Station, May, 1899), described four of these evaporators, with at least two others, as being at that time rather generally used in Washington. Of all these types of evaporators, only two have stood the test of years of practical use, and it would probably be impossible to find one of the others in operation at the present time.

The prune tunnel, or tunnel evaporator, as used to-day in the North-west has been gradually perfected by modification of the "Allen Evaporator," manufactured and patented by W. K. Allen, of Newberg, Oregon, and described by both Hedrick and Balmer in the publications just cited as in rather general use in Washington and Oregon. In so far as one can judge from the rather unsatisfactory drawings and descriptions given by these authors, the original Allen evaporator had most of the essential desirable features of the modern tunnel, with the very great disadvantage that the fruit, once placed in the tunnel, was out of sight or control of the operator until drying had been completed.

Tunnel evaporators have never come into general use in those parts of the United States in which apples are the chief fruit to be evaporated, since the labour involved in handling the fruit on trays makes the process slightly more expensive than drying on kilns. Wherever prunes and berries make up a considerable part of the total volume of fruits to be dried, tunnel evaporators may advantageously be used, since prunes must of necessity be handled in trays, while loganberries and raspberries make a very much better product when so treated.

In its essential feature the tunnel evaporator consists of a long, narrow room, with the floor and ceiling inclined uniformly from end to end, and with a furnace below the floor. The room is cut into a series of narrow chambers, the "tunnels," by parallel partitions, which may be solid or merely an open framework of slats. In some of the larger and more elaborate plants the trays upon which the fruit is spread are loaded upon trucks fitted with an open framework to support and separate them, and these trucks are rolled in one behind another at the upper end of the tunnel until it is filled. The dry fruit is removed at the lower end of the tunnel by withdrawing the truck carrying it, when the others move down by force of gravity, permitting a new truck to be rolled in at the upper end. This arrangement was a feature of the Allen evaporator. It is objectionable in that the upper and lower trays

of any given truck do not dry at equal rates, necessitating overdrying of the lower trays or transfer of the upper ones to another truck, and more objectionable in that the operator cannot learn how the fruit toward the middle of the tunnel is drying except by rolling out all the trucks until that which he desires to inspect is reached. Consequently, trucks are no longer generally employed in tunnel evaporators, and have been replaced by an arrangement which permits individual trays to be moved with little difficulty. To build this, the individual tunnels of a group or series are separated one from the other by partitions or, at least, by a framing of 2 x 4 studs. To these partitions or to the studs are nailed a series of cleats, usually made of $\frac{7}{8}$ or 1 inch strips, 2 inches wide, nailed flat, extending from end to end of the tunnel parallel with the inclined floor, and placed at equal distances, preferably 4 inches from centre to centre, apart. These cleats form a series of tracks, one above the other, which support the trays upon which the fruit is spread, and the tunnel is filled by pushing the trays in one after another at the upper end of the tunnel, and moving them along the tracks until all are loaded. The heated air is admitted at the lower end of the tunnel, from a furnace placed in the room beneath, rises through the successive series of trays, and passes off, loaded with moisture, through a ventilator shaft at the opposite higher end. Steady air movement is secured by an arrangement of air intakes in the furnace room, essentially identical with that already described for the kiln evaporator.

All that has been said in the preceding pages as to the relative merits of various building materials for constructing kiln evaporators applies equally well when the plant is to be of the tunnel type. The advantages and economy of permanent fire-proof construction are the same, as is the necessity for having the portion of the building in which the actual drying goes on as nearly air-tight as possible, and with the loss of heat by radiation reduced to the lowest possible minimum.

The building must consist of two portions, a portion in which the preparation of fruit for drying is carried on and in which the dried fruit, trays not in use, and fruit awaiting preparation can be stored, and a second portion in which the actual drying is accomplished. In the first portion or preparation room there will be needed the same equipment described in connexion with kiln evaporators, and its arrangement may conveniently be essentially that shown by the plans for such plants. If berries or prunes are to be dried in any quantity, there will be needed space on the ground floor of the building for spreading tables and for storage of trays and of boxes of fruit brought in from the orchards. Notwithstanding these facts, the plans of two-kiln and four-kiln evaporator buildings may very well serve as suggestions for buildings for tunnel evaporators. Tunnels of a given capacity occupy less than one-half as much floor space as kilns of the same capacity. The tunnels may be constructed in a portion of the space given to kilns in the plans, and the remaining space becomes available for work tables, storage of fruit, trays, &c. The plans of kiln plants have purposely been so designed that when tunnels instead of kilns are placed in them, the paring tables, bleacher, apple bins, and slicer will be as little in the way as possible when the building is used for drying berries or prunes. It is believed, therefore, that these drawings and suggestions give as much aid as possible in a publication of this general character since each builder of a tunnel evaporator must work out the details of the plan for a

building best adapted to his particular needs. Hence the detailed discussion which follows is confined to the construction and operation of the actual drying units—the tunnels.

THE TUNNELS.

The number of tunnels to be constructed must be determined in every case by the volume of fruit to be handled. It needs to be emphasized, however, that the length and size of the individual tunnel is not to be modified at the pleasure of the builder. It is usually difficult or impossible to secure satisfactory and economical results with tunnels more than 20 feet in length, since further increase in length retards air movement and therefore slows down the drying. A tunnel higher than 6 feet, or carrying more than 16 or 18 tiers of trays, will dry very slowly on the upper trays, while the work of removing or inserting trays at the top will be inconvenient and fatiguing. For the sake of convenience in handling, 3 feet in width and 4 feet in length should be the limit in size of the trays. Consequently, tunnels 20 x 6 x 3 feet are as large as can be efficiently operated, and attempts to increase any of the dimensions are likely to result in constant trouble and lowered efficiency. A tunnel of the dimensions just indicated will carry 18 tiers of five 3 x 4 trays, or 90 trays, each having a drying surface of 12 square feet. Each tray, when spread to a depth of $1\frac{1}{2}$ inches with apples, will hold about 25 lbs. of fresh fruit, giving a total capacity of 2,250 lbs., a quantity which would be yielded by 65-70 bushels of apples. Such trays will carry 25 to 30 lbs. of prunes, or 16 to 20 lbs. of raspberries or loganberries. The time required for drying will depend to such a degree upon the circulation of air though the tunnels that any statements must be taken as only indicative of what may be expected; apples will require 7 to 16 hours, berries 12 to 17, and prunes 28 to 40 hours at the temperatures recommended in a later paragraph.

The floor of the tunnel slopes uniformly from end to end, the inclination most generally employed being $1\frac{1}{2}$ or 2 inches per foot length. Two differing types of construction are employed; in one, the tunnel is tightly floored with sheet-iron throughout its length except for a distance of 2 to 4 feet at its lower end, which is directly over the furnace. In the second type, the tunnel has no floor, but is continuous with the furnace room. In either case the furnace stands beneath the lower end, and an arrangement of piping similar to that described as being used in kiln evaporators distributes the heat throughout the length of the tunnel. Each of these arrangements has its strong advocates; that last described obviously makes somewhat better use of the heat produced by the fuel.

If a number of tunnels are to be constructed, it is advisable to build them in sets of three arranged side by side and heated by the same furnace. In case the tunnels are to be constructed in blocks of three, the furnace room should be made of the same size as the block of three tunnels, except that it is 2 feet longer, or 22 x 10 feet inside the walls. This added 2 feet gives space for the furnace, which is to be set at the lower end of the tunnels (see diagram, Fig. XIX.). The walls of the furnace room may be built of stone, concrete, concrete blocks, or metal lath and plaster. The outer walls of the group of tunnels are merely

upward continuations of the walls of the furnace room, and may be built of matched lumber nailed to 2 x 4 framing, or, better, of metal lath and plaster.

The two ends of each tunnel are formed by the doors, which must be close fitting, of a height and width equal to the inside dimensions of the tunnel, and must swing back far enough to permit ready insertion or withdrawal of trays. The roof of the tunnels should be of matched lumber. The ventilating shaft, for three tunnels each 20 x 3 feet, should be not less than 5 x 2 feet in cross-section, should have a damper at its base, and should extend well above the peak of the roof of the building (see diagram Fig. IV.).

The partitions separating the individual tunnels are built of matched lumber and are carried up to within 12 or 18 inches of the roof of the tunnel. Some operators omit these partitions entirely, merely making a framework of 2 x 4's, to which the cleats which support the trays are nailed, so that the whole interior of the three tunnels is one continuous chamber. If the tunnels are walled up, the opening of one of the doors to insert or withdraw a tray interferes with the drying in that tunnel only, whereas in the absence of such walls the opening of any door results in the cooling down of the entire system. Even were this not the case, the more uniform and rapid movement of air through the tunnels, and the comparative freedom from dead-air pockets secured by the separating walls, well repays the expense of their construction.

The Furnace Room.

If built in accordance with the suggestions made above, the furnace room will be 22 x 10 feet in size. The height to the floor at the lower end of the tunnel should be 7 feet; a rise of 1½ inches per foot in the floor would give a height of 9½ feet at the opposite end, while a 2-in. rise would give a height of 10 ft. 4 in. The walls may be of stone, brick, concrete, or metal lath and plaster; if built of wood, they must be lined with asbestos sheeting to reduce the danger of fire. Since the cost of such a lining will bring the expense of construction very nearly up to that of a concrete wall, it is the part of wisdom to cut the fire risk to a minimum by avoiding wood altogether.

Adequate provision for an abundant supply of air is absolutely necessary. For three tunnels of the size here suggested, the furnace room should have four air inlets, one in the centre of each of the walls, each 3 x 1½ feet in size, and placed about 6 inches above the ground. These will give a total air inflow of 2,592 square inches. It will rarely be necessary to open all of the inlets to their full capacity, and sliding doors should be provided in order that any of the inlets may be partially or wholly closed at will, but there will be an occasional still, humid day when the entire capacity of the air-intakes will be used

If the furnace room occupies only part of the lower floor of a larger building, provision must be made for free access of air to the intakes on the enclosed sides. This may best be secured by excavating the furnace room to a depth of 12 to 18 inches, elevating the floor of the remainder of the building, and providing numerous ventilating openings in the foundation walls, through which air may move freely beneath the floors to the furnace room inlets.

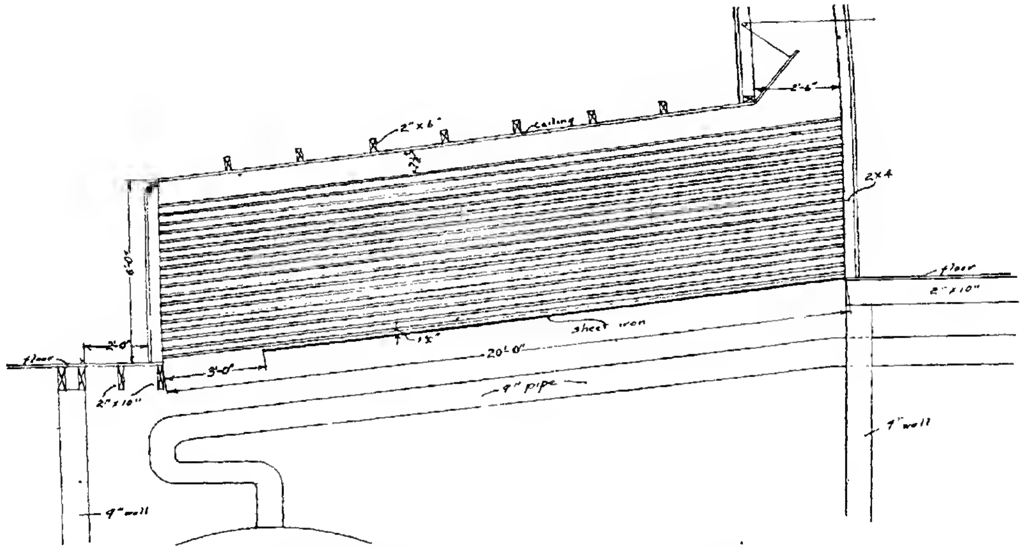


Fig. XIX.—Sectional Side View of Tunnel Evaporator.

Tunnel 20 x 6 x 3 feet, carrying 18 tiers of trays. Free air spaces of 7½ inches above upper tray and 1½ inches between floor and lowest tray. Furnace directly beneath opening 3 x 3 feet in size at lower end of tunnel. Piping of furnace extended beneath floor of second story to chimney at side of building.

The Furnace.

The statements made in the section devoted to heating apparatus for kilns holds true here. The only economical and durable heating equipment is a well-built brick or stone furnace, lined with firebrick, of sufficient height and depth to take ordinary cordwood without preliminary splitting or cutting to shorter lengths. The ordinary hop stove, built as it is of thin sheets of cast-iron, will not stand up under the continuous heavy firing of a 50 or 60-day apple-drying season.

If the tunnels are floored except for a distance of 2 to 4 feet at the lower end, the furnace should stand immediately below this opening in order that the heated air may pass directly upward into the lower end of the tunnels. The fact that the furnace room is 2 feet longer than the tunnels permits the furnace to stand in this position. The chimney should be placed at one side of the building, the pipe rising from the furnace should be fitted with a T joint, and the two lines of pipe carried around the walls of the room before they are connected with the flue, as described in the section on piping of kiln furnaces, page 24. If the floors are of sheet-iron, the pipe may be brought up to within 24-30 inches of the floor and kept at that distance in its passage around the room; if the tunnels have board floors or no floors at all, it must be kept about a foot lower to prevent overheating. The "single-pipe" system of piping will give sufficient radiating surface, and the distance of the pipes from the walls should not be less than 24 inches. The pipe should be of the quality recommended for use with kiln furnaces, and should be 9 inches in diameter. The chimney should be, at least, 12 x 12 inches inside, if only one furnace is piped into it, 12 x 18 if two are connected with it. It should be solid up to within 18 inches of the entrance of the pipes, and should extend 4 or 5 feet above the roof. As free access to both ends of the tunnel is necessary, the chimney should stand at the side of the building, with the pipe passing beneath the floor to reach it.

The Construction of Trays.

Trays are best made from $\frac{7}{8}$ x $1\frac{1}{2}$-in. slats. Cut two pieces 3 feet and two pieces 4 feet long, nail these together to form a rectangular frame 4 x 3 feet and $1\frac{1}{2}$ inches deep. Cut a piece of wire-netting 1 inch larger each way than the frame, turn the edges back to give a firmer hold for nailing, and nail the netting to the frame. Now cut a second set of slats and nail these to the bottom of the tray, taking care that the wire is not allowed to project. Lastly, nail a wooden strip across the middle to prevent warping of the frame. This gives a reversible tray, which has no projecting wires to tear clothing and hands or catch in the tunnels. The bottom cannot become loose from the frame, and can be kept from sagging by using the tray either side up.

Trays should be made of the best grade of galvanized wire-screen obtainable, with meshes $\frac{1}{4}$ or $\frac{1}{3}$ inch square. An inferior, poorly-galvanized wire will be attacked by the acid juices of the fruit with discolouration and injury to the product. The German Government has long made strenuous objection to the use by her people of apples dried on wire trays, on the ground that such fruit may absorb sufficient quantities of zinc to be injurious to consumers. While this claim is not borne out by the results of chemical analysis, it has resulted in laws prohibiting the sale in Germany of apples containing more than a specified amount

of zinc. While this amount is much less than is found in fruits dried on well-galvanized trays, it may be reached or exceeded when an inferior wire is used in making trays, or when trays become rusty from long continued use. The employment of wooden trays offers a theoretical solution of the difficulty, but unfortunately there are practical difficulties which prevent their use; such trays are expensive to make and heavy to handle, the strips making up the bottom must be so narrow, in order not to impede the circulation of air, that they are very fragile, unless made of some hard, tough wood, as hickory or rattan, and the fruit sticks rather badly unless the trays are oiled. For all these reasons, the use of metal trays seems practically unavoidable, but the operator should promptly discard those in which the destruction of the zinc coating has occurred.* To paint such trays with white lead, as some operators do, is simply to add the more poisonous metal lead to the fruit, and such treatment of trays is fraught with danger of serious consequences to the consumer of the product.

The Operation of the Tunnel Evaporator.

The method of operation of the tunnel evaporator differs from that of other driers in two respects: first, the fruit is subjected at the beginning of the process to a very moderate temperature, which is steadily increased as the drying proceeds; second, the warm air at its first entrance to the tunnel comes into contact with the dryest fruit, then with that containing more and more water, until it reaches fresh fruit, and becomes saturated with moisture immediately before finally passing out of the tunnel. It is generally claimed that such fruits as apples and berries retain more of their natural flavour when subjected to a temperature not higher than 120-135 degrees Fahrenheit in the first hours of drying, but that the temperature may advantageously be gradually raised to 150-165 degrees after the fruit has given up a portion of its water content. There is the additional advantage that berries kept at 120-135 degrees until drying is well begun do not have their cellular structure broken down, hence do not run together into compact masses, while neither berries, prunes, nor apples lose a portion of their sugar by "bleeding" or dripping, as is the case when materially higher temperatures are used at the outset. Consequently a heavier product with a larger sugar content is obtained by maintaining a moderate temperature at the outset, facilitating the drying by increasing the heat only after the fruit has lost so much water that dripping no longer occurs. The tunnel evaporator provides at one time the various temperatures needed, since it is hottest at the lower end, directly over the furnace, and the temperature steadily decreases toward the upper end; also the temperature at any point near the top of the tunnel is considerably below that at a corresponding point near the bottom. Consequently, fresh fruit introduced at the upper end of the tunnel, near the top, and pushed along the tracks until it is finally removed dry at the lower end, is subjected to a steadily increasing temperature throughout its stay in the tunnel.

The second distinctive feature of the tunnel evaporator has an obvious advantage. The heated air upon entering the tunnel passes over fruit

* The following note is supplied by Mr. J. Farrell, Orchard Supervisor, Victorian Department of Agriculture:—If the wire netting of the trays be painted with lacquer and thoroughly dried before the trays are used, the spelter will be protected from the corrosive action of the apple acids in combination, or when mixed with the residue of the salt solution and that of the sulphur fumes.

which is almost dry, and which consequently gives up only a small fraction of the amount of moisture which the air is capable of carrying. Thence the air rises through successive layers of fruit, each containing more moisture than its predecessor, until finally, just before entering the ventilator shaft, it passes over trays which have just been inserted. The tunnel thus exactly reverses the method of the old tower evaporator, in which fresh fruit was put in at the bottom, nearest the source of heat, and the moist air driven from it through the trays of partially dried fruit above. In such towers the air often had its temperature so much lowered before reaching the top of the stack that a part of the moisture carried by it was deposited upon the fruit in the upper trays. In the tunnel this is entirely avoided, and the time required for drying is very materially shortened, with a corresponding improvement in the quality of the product.

When the plant is operating, fires are kept going continuously in the furnaces, and trays of fresh fruit are inserted at the upper end of the tunnels as they are prepared. During the day, the tunnels will usually be kept full to capacity by the replacement of the finished trays, as rapidly as they are withdrawn, by trays of green fruit, which necessitates the occasional shifting downward of the partially dried fruit to make room at the top. In the afternoon, before the employees cease work for the day, all other work may be stopped, and a sufficient number of trays filled to replace those which will become dry during the night. These are stacked near the tunnels. It is the duty of the night man to keep up the fires, to remove such trays as become dry, to keep the unfinished trays compactly together in the lower portion of the tunnel, and to put in fresh fruit as room is made for it. This method has many advantages; it prevents the overheating and scorching likely to occur when the tunnels are gradually emptied during the night; it utilizes all the heating value of the fuel burned, and it gives continuous operation at full capacity, hence at a lower cost.

Nothing will aid more in the rapid and economical drying of the fruit than constant attention to the ventilation. The air-intakes into the furnace room must be adjusted anew with every change in the force and direction of the wind, and the damper in the ventilating shaft must be at one time widely open, at another almost closed. The plant cannot be left in charge of a man who is either careless or unintelligent, he must understand clearly that it is just as much a part of his duty to maintain a vigorous draught through the tunnel as it is to keep the temperatures shown by the thermometers in the tunnels constant, and that failure in either of these respects results in slower drying and an inferior product of greater cost. Consequently, the kiln man should be the most intelligent and capable employee about the establishment. If there is any difference, the best man should be selected as night man, since the greater humidity and lower air temperatures prevailing at night make the task of securing satisfactory drying during that period a very difficult one. Once the kiln men are selected and put to work, they should be held responsible for the management of the drying rooms, and no interference by others should be attempted or tolerated. "Many cooks spoil the broth" is a proverb never more true than when applied to the ventilating and heating of an evaporator.

(*To be continued.*)

NOTES ON DOWNY MILDEW

(*Plasmopara viticola*, B. and de T.)

By F. de Castella, Government Viticulturist, and C. C. Brittlebank, Government Pathologist.

Until last summer the vineyards of Australia were free from Downy Mildew, that great scourge of vineyards in the moister European climate. It is true that one isolated case of the appearance of the fungus was previously recorded, though it did not occur in a commercial vineyard. The late Baron von Mueller, at that time Government Botanist, noticed that a vine in his private garden at South Yarra was affected by a parasitic fungus, which he took to be Mildew; a diagnosis which was confirmed by Dr. M. C. Cook, to whom specimens were sent. The Baron eradicated and burnt the vine, and with this single exception the fungus had not been observed on the Australian continent until last summer, when it was found to be rather widely disseminated throughout the north-eastern district of Victoria.

Will the disease re-appear? Is it likely to give serious trouble? What steps can best be taken to guard against such? These are questions which it is only logical to ask. The present season, being even wetter than its predecessor, makes it extremely probable that we shall again have the fungus with us.

It is the object of the present article to briefly record last year's outbreak, to explain how the disease may be identified, and to point out what preventive steps can best be taken to combat it, in the light of recent European experience, should the disease again appear in our vineyards.

The 1917 Outbreak in North-East Victoria.

On 31st January, 1917, whilst inspecting the Rutherglen Viticultural Station, Mr. de Castella was informed by the vineyard manager that a disease had appeared at the Wahgunyah Nursery which differed from ordinary Oidium. More detailed description aroused suspicions, which were confirmed when the vineyard manager found a couple of similarly affected leaves on a vine of Aramon Bouschet. These were immediately posted to Melbourne, and were found by the Vegetable Pathologist (Mr. C. C. Brittlebank) to be undoubtedly affected with Downy Mildew *Plasmopara viticola*. The number of diseased leaves at the Viticultural Station was exceedingly small. It was only after careful search that any could be found showing the characteristic white down on the under side.

The Wahgunyah Nursery was inspected the following day; here the fungus was very much more in evidence; one block of Rutherglen Pedro grafts was badly affected, nearly all the leaves being more or less contaminated, whilst some Muscat and Grenache showed the fungus to a lesser extent. The greater part of the nursery, however, was practically free from the fungus. Immediate spraying of the whole nursery with copper soda was, nevertheless, ordered.

At a vineyard a couple of miles up-stream from the nursery, and at another 5 miles further up, leaves showing the characteristic white down were also to be found, especially on vines close to the Murray River. A

week later (7th February) the disease was found in vineyards near the river a couple of miles below Wahgunyah, and on the following day in a vineyard on the hill top, a mile south of Rutherglen. It was further found at Fairfield on 16th February, and at such fairly remote localities as Milawa (28th February), Barnawartha (1st March), and Glenrowan (12th March). A week later the Government Pathologist visited Rutherglen; examination *in situ* absolutely corroborated previous laboratory diagnoses, leaving no possible doubt as to the identity of the fungus.

Except in the vineyards along the Murray, the fungus was very little in evidence; in many cases it was only after careful search that characteristic specimens could be found. This was particularly so at Fairfield; though odd leaves here and there showed suspicious brown spots, it was only in one small portion of the vineyard, near a dam, that these bore any white down underneath; even here, very few such leaves were to be found.

At the Viticultural Station, though very scarce at first, the fungus increased somewhat later on in the season, and by 15th April, when the annual Field Day was held, specimens were sufficiently numerous to familiarize visitors with the outward appearance of the disease. They were, however, practically confined to the two rows of the collection (Viniferas) nearest to a large open drain. Though no water was present in this, except immediately after rain, it evidently increased atmospheric moisture sufficiently to permit contamination which was practically impossible in the rest of the vineyard.

From the above it will be seen that the fungus suddenly made its appearance throughout an area of country of several hundred square miles. The Viticultural Station is 10 miles from the Wahgunyah Nursery, whilst Barnawartha, Milawa, and Glenrowan are respectively, and as the crow flies, 12 miles east-south-east, 28 miles south, and 24 miles south-south-west of Rutherglen. The Wahgunyah Nursery is 7 miles west-north-west from Rutherglen. Though they were not observed until somewhat later, the more remote outbreaks must have commenced simultaneously with those at Rutherglen.

The outbreak generally was of a very mild nature; no damage was done, and the fungus was not sufficiently in evidence, at least in any of the vineyards affected, to cause apprehension, or to lead to spraying being recommended. In the case of an earlier visitation, treatment might have been advisable; but in February, when the grapes are about to change colour, bunch contamination could no longer occur, and unless abundant warm rains were to fall, there was no reason to fear wholesale dropping of the leaves, which is so fruitful of damage in Europe.

At the nursery things were somewhat different; and as early as 1st February the urgent need for immediate spraying was evident. One application, however, sufficed to save the foliage and enabled the young grafted vines to properly mature their canes, even on the worst affected blocks. Though generally present throughout the nursery, some blocks were much more affected than others, no doubt owing to irrigation having taken place at such an interval after a shower of rain as to increase what is termed in France the "receptivity" of the young vines; in other words, the facility for contamination by the fungus.

This much greater susceptibility of young nursery vines is no doubt due to plentiful moisture resulting from the frequent but indispensable

waterings, and the proximity of the young growth to the moist soil surface. It has also been noticed in France, as will be seen from the following extract:—*

The defence of young nursery vines against Mildew presents, as is known, great difficulty. Weekly, and even daily treatments, according to some, have not always given satisfactory results, because of (1) abundance of winter spores left by previous nursery operations; (2) proximity to the soil, where dew and moisture persist longer than at a certain height from it; (3) the necessary waterings; (4) the late start and late growth of the scion shoots, which cause the disease to develop with a violence, and especially with a persistence very rare in the open vineyard.

It might appear at first sight, especially to those inexperienced in the treatment of this particular fungus, that energetic steps in the direction of wholesale spraying should have been taken, with a view to stamping out the disease in its early stages. Any such action would have been very costly and quite futile, in view of the widespread nature of the outbreak at the time when the fungus was first identified. Absolute extermination of this, as of any other fungus, once it has become fairly widespread, is, of course, altogether out of the question, and in view of the very small extent to which the fungus could be found in any one vineyard wholesale spraying could not logically be recommended, much less insisted on.

Mildew belongs essentially to the category of fungi, the dissemination of which is exceedingly rapid, given suitable weather conditions. It differs radically from several other slow spreading diseases, such as Black Spot, for example, in that, given an exceedingly limited source of infection and suitable weather conditions, wholesale contamination soon results.† In other words, the number of spores present is of little consequence in deciding whether a severe outbreak will or will not take place; this depends exclusively on the weather. Unless atmospheric conditions prevail, altogether different from those usual in our inland climate, the spread of the fungus is impossible.

That the severity of an outbreak of Mildew depends on suitable climatic conditions, and not on the number of spores which started it, receives confirmation from a recent article by M. J. Capus‡ dealing with the behaviour of Mildew during the French summer of last year.

"It is easy to understand that Mildew, with its extraordinary variations from one year to another, should disconcert vine-growers." . . . . In answer to a correspondent, he continues, "It is true . . . that we are far from knowing everything concerning the evolution of Mildew, nevertheless we are equally far from being altogether ignorant concerning it. . . . All the factors which act on fungi are probably known to us; but what we do not yet know thoroughly is the precise moment when each factor commences to act, the extent of their actions, and the reciprocal influences they exert upon one another.

The scarcity of the disease in the vineyards of France, considered as a whole, following on a year of invasions as severe as last year's were, shows clearly, once again, that *abundance of germs at the close of a season does not fatally indicate that invasions will be serious the following year*—(the italics are ours). It is not the first time that a year free from Mildew follows a year when it was redoubtable; on the other hand, the disease has frequently been known to cause serious damage after having disappeared from the vineyards for one or more years. *It is not the number of germs that matters*, it is the fate with which they meet in the shape of atmospheric conditions.

* L. Ravaz, in *Progres Agricole*, 9th April, 1916.

† "One single vine infected in spring suffices for the disease to spread immediately to a distance under the action of the most gentle breeze which transports the conidia . . . ." P. Viala.—*Les Maladies de la Vigne*, p. 109.

‡ *Revue de Viticulture*, 3rd August, 1916.

At the commencement of the **1916** season there was every reason to fear severe visitations: plentiful germs from last year, a moist soil during spring, and sufficient rain to permit contamination. In the development of this disease, however, it is not sufficient that a group of favorable conditions should occur; it is essential that every condition should be favorable. It is sufficient that one such should be absent in order for the invasion to fail. Now, in June, 1916, the soil was unusually dry . . . . hence low receptivity of the vine for the disease. This view receives confirmation from the fact that, at many points, though invasions exist which are at least two or three weeks old, they are discernable in the shape of spots which are only visible by transparence, and which have failed.

But all districts were not equally fortunate: in certain centres, fortunately very limited, ... the disease has been able to develop very freely, and several invasions have appeared on leaves and bunches. Such contaminations are all distinguished by the fact that at least one heavy fall of storm rain occurred which wetted the soil and left it wet. This rain did not cause contamination, but it favoured the appearance of down beneath the spots, which were only waiting for it, and which in its absence would most probably have continued to remain latent, and would have failed."

The origin of the 1917 outbreak is and must remain obscure, but there can be no doubt that the abnormal weather conditions of last summer permitted its development and spread over the large extent of country mentioned above. The weather conditions during the 1916-17 summer were altogether abnormal. Hot north winds, usually so common in northern Victoria, were conspicuous by their absence; on the other hand, rains were frequent, the following falls being registered at the Rutherglen Viticultural Station during January and February, 1917:—Sixteen points on 12th January, 42 on 13th, 23 on 21st, 11 on 27th, 29 on 31st; 31 on 1st February, 7 on 6th, 22 on 16th, 4 on 18th, 5 on 19th, 21 on 20th, 36 on 21st, 7 on 22nd, 34 on 23rd, and 5 on 26th. Heavy night dews, quite unusual in the district, were common, and fogs, most unusual summer visitations on the Murray, occurred on several mornings. In the opinion of the writers, it is solely owing to the unusual amount of moisture present last summer that the fungus was able to show up at all. Whence did it come, and by what means was it introduced? These are questions which can never be answered.

The grafted resistant rootlings largely imported from France at various times during the past ten years have been suspected as carriers, and it is quite possible that this view is correct. It is equally possible, however, that the fungus was introduced with dried grapes from Spain, Greece, or Turkey, in all of which countries the fungus is abundant. The outbreak in Baron von Mueller's garden, at any rate, did not originate through importation of vines from France.* It is quite probable that the fungus has long been with us, but, owing to climatic conditions, it was not until the very wet summer of 1916-17 that the white, downy efflorescence was able to manifest itself, and without this the fungus cannot be readily identified. Even though infection should take place, and the fungus obtain an entry into the tissues of the plant, its development may only reach the stage characterized by the appearance of the yellowish-green spots (becoming brown later) known in French as *taches d'huile*, or "oil spots." Unless sufficient moisture be present, these are unable to sporulate, and there is no appearance on the under surface of the leaf of the characteristic white down, without which the identification of the fungus is only possible by microscopic investigation or artificial incubation in moist media.

* It is inconceivable that the Baron should have disregarded the stringent legislation then in force against the introduction of vines and the heavy penalties it provided.

These oil spots, and especially the brown or dead portions of leaf they result in, are not very characteristic; various causes may lead to quite similar manifestations. Possibly such may have occurred on several previous occasions, but without attracting the attention of vine-growers. The behaviour of the fungus at Fairfield, as described above, is quite in accord with this view.

The Preponderant Influence of Climate.

Such freedom from the fungus, almost amounting to immunity, is not peculiar to inland Victoria. It is also a feature of several countries with dry climates—California, for instance. Though Downy Mildew is prevalent to an extraordinary extent in the Eastern States of the North American Union,* so much so that European vines cannot be profitably cultivated, it is practically unknown west of the Rocky Mountains, where climatic conditions are very similar to those of northern Victoria. Possibly Mildew may do some damage in the coastal districts of New South Wales and Queensland, but Victoria and South Australia have far less to fear, at least in normal seasons.

As regards the absence of Downy Mildew from California, Professor Bioletti, in reply to inquiries on the subject, wrote as follows in 1910:—

> This disease has never been found in California, so far as I am aware. It is reported that Dr. Harkness, of the California Academy of Science, once collected a specimen of Peronospora† on a wild vine in the Sacramento Valley, but the specimen was burnt up in the fire, and in any case it simply proves the extreme rareness of the disease, if it occurs at all here. Anthracnose and Black Rot are also unknown here. Indeed our only serious fungus disease of the vine is the Oidium, and even this, except along the fog belt near the coast, is very easily controlled.
>
> I think the evidence is conclusive that the reason the serious fungus diseases of the vine do not occur in California is that the climate conditions prevent them. Vines are being continually imported from the eastern States and from Europe, and until lately most of them were not disinfected in any way. It seems certain, therefore, that the spores of all these diseases must have been introduced many times. Our dry summer, four months absolutely without rain, and two or three months with very little rain, sufficiently accounts for the difficulty these diseases encounter in becoming established. All I have read of the climate of the main vine-growing regions of Australia shows that it resembles very closely our climate, and if this is true, you need have no fear of the introduction of either Black Rot or Peronospora.

Likewise in South Africa, as will be seen from the following extract from a reply received from Mr. Watermeyer, manager of the State Vineyard at Constantia:—

> *Plasmopara viticola.*—This disease was first found to exist in this country in the Botanic Gardens at Grahamstown, in the Eastern Province, late in January, 1907. No clue exists as to how it came, for no one there imported grape vines from Europe. It is not an important grape-growing centre, but there are vineyards scattered all over the place, and most were found to be infected. Some growers were inclined to the belief that the disease was long established, but had previously been confused with the more common diseases, as Oidium, &c. The disease made its appearance after most favorable weather conditions for its development. Subsequently all districts to which Grahamstown vine nurserymen had sent cuttings were inspected, also all the important viticultural districts of the colony, in the Western Province. In the latter no infection was found.

* Downy Mildew is in fact indigenous to that part of North America east of the Rocky Mountains. It was from here that it was introduced into Europe in 1879, according to P. Viala, *Les Maladies de la Vigne*, p. 77. "In the first year of invasion in France, in 1879, it was not observed until fairly late. Since then the parasite has appeared as early as the month of May, but never before, since 1879 until 1892. It is well to note this fact, because it should guide for fixing the periods for treatment."

† The Downy Mildew fungus was formerly known as *Peronospora viticola*, a name which has since been changed to *Plasmopara viticola*. The older name is still very usually given to it in France.

As a result of the inspection some twenty-five districts were found infected. None of these, however, with perhaps the exception of one, could be regarded as of any viticultural importance. In some centres the disease appeared in a most virulent form. No damage, however, occurred to crops or grown vines, but nursery stock suffered. Up to the present time the disease has been reported off and on, but never as having done any damage either to growth or crops, nor has it yet spread to the great vine areas in the Western Province, and the general opinion is that it is not likely to, on account of the cooler climatic conditions here, and where the greatest rainfall is in winter, whilst the areas that are infected are situated in the midland, northern, and eastern parts of the Cape Colony, which enjoy summer rains and the disease develops after these, when great heat gives rise to a steamy hot atmosphere, as in tropical climes. Were it likely that the disease would find a home in the Western Province vineyards, it must have established itself long ago, for Government regulations (copy of which I inclose) to control infection are constantly ignored, and it is to the writer's knowledge that boxes of grapes from a badly infected area centre, "Graaff-Reinet," are brought into the vineyard centres of the Western Province for consumption. Also specimen leaves and grapes have been sent direct to me from these areas, and yet after ten years now no Western Province vineyard has been found to be infected. So that if your climatic conditions are similar your growers need have no apprehension.

With regard to spraying, this was done on nursery stock at Grahamstown, when the disease first appeared, but that it has become a practice in large infected areas, I can safely say no. And the expense does not appear to be justified, for no serious damage is caused. The fungus makes an appearance when conditions suit it, and these do not seem to endure long, when it dies again.

Take the history of its discovery here. It appeared after the first heavy rains, then there was a period of dry weather, the vines continued to develop, matured their fruit, and after the crops had practically been gathered, there was rain again, and again an appearance of Plasmopara, when the under-surface of the leaves were a mass of down, and visible from a considerable distance; yet the following years there was normal growth, and there were normal crops. The quarantine restrictions are, however, still in force, but, as you notice, are not strictly adhered to.

Also in Algeria, the climate of which is not unlike ours, though scarcely so dry, Mildew is much less feared than in France. According to Rivière and Lecq*—

Thanks to the absence of summer rains, vegetable and animal parasitism has never, even on the coast, an intensity to be compared with that observed in France, especially in 1910, and it is always easy for a watchful and prudent vine-grower to combat it victoriously without heavy expense. Many viticultural regions at some little distance from the sea are unacquainted with *Sulfatages* (spraying with copper mixtures), and scarcely do any sulphuring.—P. 557.

and again, p. 806—

In Northern Africa it (Downy Mildew) only causes anxiety near the coast (regions of Alger, Bone, and Phillippeville), and always yields to appropriate treatment properly applied. It sometimes shows itself after the end of April on leaves and embryo bunches. The Siroco (warm south wind) checks its development.

The comparative freedom of Algeria is further instanced by the great popularity of Carignane, which was until recently the most widely cultivated vine. As it is also one of the most susceptible vines to Downy Mildew, it could not have attained this popularity if this disease was at all prevalent. Carignane is now being superseded by other sorts, owing to its rather faulty affinity for resistant stocks.

During the past and present seasons climatic conditions on the Murray have been absolutely different from those which usually prevail. There is a very striking contrast, in normal seasons, at least, between the climate of this region and that of even Southern France, where

* *Traité pratique d'Agriculture pour le Nord de l'Afrique*, by Rivière and Lecq (1914).

Mildew visitations are much less intense than in the moister centre and north. In France the warm south winds cross the Mediterranean, and are saturated with moisture, causing heavy dews at night, which, to an Australian, seem very curious in hot weather. It is the cold north wind which is dry. This is known in the south as the "Mistral"; when it blows Mildew is not feared.

In Victoria we have no moist wind; our sea breezes are too cold to hold much moisture. On the other hand, our dry north winds are our greatest safeguards against fungus pests of all kinds. The almost complete absence last season of this characteristic feature of our climate is one of the main factors which rendered last year's outbreak possible.

Outward Appearance of the Disease.

All green or herbaceous parts of the vine are liable to attack—stems, leaves, tendrils, or bunches—but it is usually first observed on the leaves, on which it manifests itself in the shape of spots at first of a lighter or yellowish green, more or less circular, and varying in size from that of a sixpence to a shilling, and even larger. These spots become yellowish, then brown, and finally die out altogether. In the early stages they are more easily distinguished if the leaves are held up to the light, owing to their being more transparent than normal leaf tissue; hence the French term of "oil spots," which aptly describes them. After a while, on the under side of the spots, provided climatic conditions are suitable, a milk-white efflorescence, or down, makes its appearance—whence the name of Downy Mildew, as distinguished from Powdery Mildew, the name given to Oidium (*Uncinula spiralis*) in America. This white down is very characteristic, and readily distinguishes this from any other vine fungus. It is close, dense, and glistening, and reminds one of fine table salt or sugar. Except in very rare cases, it is only visible on the under surface of the spots already mentioned, which are thus yellowish-green or brown above and white beneath.

In dry weather the characteristic down does not develop, the spots dry up, and assume a dead-leaf colour, without sending out the spore-bearing filaments, which constitute the down. In moist warm weather the down is very apparent, being often similar to a dense white felt, but in dry weather it may be entirely absent or very scanty. If suspected leaves are placed for a day or two in a warm dark place wrapped in a moist towel, the white down will make its appearance.

Mildew is quite different from Oidium; the latter appears equally on the upper and under surface, and never causes brown spots. The mottled appearance sometimes presented by leaves attacked by Oidium is quite different to the well demarcated spots of Mildew. The white downy efflorescence only appears on the under side; it is much denser and whiter than Oidium, which develops on upper and under surface alike.

Mildew is also very distinct from Erinose, though at first sight there might appear to be some similarity; the spots of the latter are always convex above—they resemble hollow warts; Mildew spots are always quite flat. In the case of Erinose, the felt inside the hollow warts, though white at first, soon becomes rust colour; Mildew down is always white.

When other organs, such as canes or bunches, are attacked they also show yellowish-green patches, the white down appearing later. If

bunches are thus attacked before or shortly after blossom, they are said to suffer from grey rot. If infested when half their full size, the berries first become soft, and later dry out. This form of the disease is known as brown or soft rot.

How Damage is Done.

Mildew may destroy the crop in three different ways. If it appears early, just before, during, or just after blossoming, it may invade the young bunches, causing them to dry and fall off. This form, which is termed grey rot, has been known to destroy the entire crop in a couple of days in certain moist districts of France. Brown rot, when the berries are rather more than half their full size, is also responsible for much loss. Once the berries commence to change colour, the fungus is no longer able to penetrate the tissues; the fruit is safe from infection.

The most usual way in which injury is caused, however, is by bringing about a premature fall of leaves; badly infested leaves drop off, often at the junction with the stalk, which is left adhering to the canes. Vines thus stripped of their leaves cannot ripen their fruit properly. Grapes borne by vines affected with Mildew yield but little juice, and the wine made from them is of very poor quality—only fit for distillation. The must is rich in nitrogenous substances and unsuitable for the healthy growth of yeast. Not only is the current season's crop injured, but that of the following season is seriously compromised, since the premature stripping of the leaves prevents the accumulation of reserve substances in the vine, so that the following season few bunches are formed. The damage is similar to that caused when the foliage of the vineyard is fed off by stock too soon after vintage.

Life History.

Space will not here permit of more than a brief outline. The botanical name of the fungus is now *Plasmopara viticola*. Formerly it was known as *Peronospora viticola*. It is closely related to Irish Blight of the potato. Like most fungi which prey upon the vine and fruit trees, but in striking contrast to that of Oidium, the mycelium* grows in the interior of the host plant. It is only the fructifications bearing the summer spores which are outside. This internal nature of the mycelium is of vital importance in connexion with treatment, which cannot possibly be curative, as sulphuring is in case of Oidium.† The mycelium develops in the inside of the tissues, which are disorganized and broken down under its influence, thus causing the "oil spots" already described. After a time, but only if weather conditions are sufficiently moist, the fungus sends out, through the stomata or breathing pores on the under side of the leaf, strands bearing conidia or summer spores. These conidiophores, as they are called, somewhat resemble a bunch of grapes, the conidia being the berries (see Fig. I.). It is thousands of these, massed closely together, which constitute the white down characteristic of the fungus.

* Mycelium, according to de Bary, is the vegetative portion of thallus of fungi, composed of one or more "hyphae." It is the growing (and feeding) portion of the fungus as distinguished from the spore-bearing or reproductive part. In edible, cultivated mushrooms it is popularly known as spawn.

† In the case of Oidium the mycelium is on the outside of the tissues; it is only the suckers sent out from it which penetrate the outer skin of the vine to absorb nourishment.

The mechanism of infection may be briefly described:—Each one of the conidia falling into a drop of water on a healthy leaf, under suitable temperature conditions, is capable of causing a fresh spot—a fresh infection. The time which elapses between the entry of the fungus from the germinating spore until the oil spot becomes noticeable is known as

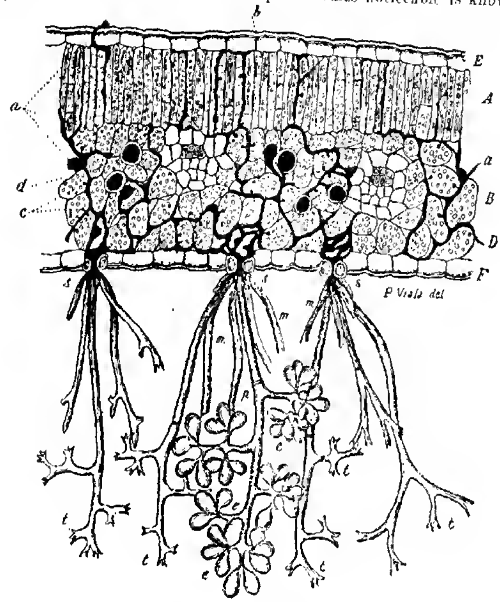


Fig. 1.

Downy Mildew—*Plasmopara viticola*, B. and de T.

Diagrammatic section of a vine leaf infested with Downy Mildew, showing how the mycelium of the fungus (*a*) circulates between the cells which constitute the normal tissue of the leaf. At s, s, s are three stomata or breathing pores, through which the conidiophores or spore-bearing filaments emerge. It is these which constitute the characteristic white down on the under side of the leaves. Conidia, or summer spores (*c*) are, however, only shown on one filament. The round black bodies with white rim, in the interior of the leaf, are oospores.—After Viala.

the period of incubation;* it is of very considerable importance in connexion with the treatment of the fungus.

The germination of the conidia takes place as follows:—The interior substance splits up into several small bodies called zoospores, which swim about in the drop of water until they find stomata or breathing

* We understand by "period of incubation" the period which elapses between the penetration of zoospores and the appearance of the first symptoms revealing to the naked eye the presence of mycelium in the organs attacked, (oil spots on the leaves, yellow-brown colour on bunches, tendrils, and tips of canes).—*Gy de Istvanffi*, page 94

pores, by which the germ tubes can gain entry into the interior of the tissues, where the mycelium grows rapidly, forming the characteristic "oil spot." Germination of conidia is impossible unless in a drop of water, and this must remain on the surface of the leaf for a sufficient time. Even though germination has occurred infection cannot take place unless one or more of the zoospores can reach a stoma or breathing pore; they are incapable of penetrating the outer skin of the vine at any other point. The stomata of the vine are to be found almost exclusively on the under surface of the leaf. There are scarcely any on the upper side. Hence infection occurs almost exclusively on the under side of the leaf.

According to Ravaz (see p. 696), the period of incubation in France is usually seven days. After the lapse of this time, the oil spot is fully formed and ready to produce spores in enormous numbers *should weather conditions prove suitable;* otherwise no harm can result, though it continues to be a source of danger, since in mild, but dry weather, it can remain latent for a varying time, only awaiting moist conditions to permit sporulation. The oil spot stage may thus be compared to a loaded gun, only needing the pull of the trigger, in the shape of a spell of wet weather, to discharge an enormous number of spores. Should wet weather continue, and copper spray protection be absent or insufficient, wholesale new infection will occur.

If, on the other hand, hot weather should supervene, even though the oil spot has duly incubated, further infection need not be feared. The spots become darker and dry off to dead leaf tissue, soon losing their power for further harm. Professor Ravaz describes (*Progres Agricole*, 22nd July, 1917) how an invasion, that of 3rd July, "had been checked in its development by the very hot weather of 4th July (91° F. in the shade) and following days, which . . . . destroyed almost the totality of the old spots and the germs they bore. . . . Everything was dry, both leaf tissue (damaged) and the innumerable white efflorescences they bore. . . . The conidia under the microscope were shrivelled or showed a granular content. At any rate, they were no longer able to germinate.

Conidia do not retain their vitality long*—according to Gregory, they last about a week under normal conditions. In hot weather they soon shrivel up and die; they are unable to last from one season to another. Nature has devised another means by which the fungus can perpetuate itself and survive the winter period. Towards the close of the season the mycelium produces, in the interior of the leaf, a varying number of very resistant bodies called oospores or eggspores (see Fig. 2); these have a tough envelope, which lasts through the winter, only germinating the following spring, when each one gives rise to one single large conidium, which germinates by zoospores, as described above. These are splashed by rain on to the lower leaves of the vine, whence infection spreads with extraordinary rapidity. Unless very wet weather prevails, the oospores will not germinate, nor will the zoospores be able to infect the tissues of the vine; in other words, no outbreak is possible. These oospores are so resistant that if sheep are fed on infested leaves they will be found uninjured in the sheeps' droppings.

* Studies on *Plasmopara Viticola* by C. T. Gregory, Cornell University, in official report of the session of the International Congress of Viticulture, San Francisco, Cal. July, 1915.

Treatment.

In view of the above, it is evident that the treatment used to combat Mildew must be radically different to that for Oidium, the exterior mycelium of which is easily destroyed by dusting with sulphur, provided, of course, that weather conditions are suitable for its action. The Mildew is, however, inside the tissues, where no spray can possibly reach it. We can cure Oidium, but the treatment for Mildew must be preventive. It is necessary to spray the vine with a substance poisonous to the fungus, and in sufficient quantity for every rain or dew drop to dissolve a sufficient proportion of the poison to prevent the germination of any conidia which may fall into it. Various preparations of copper are used for the purpose, the best known of which are Bordeaux mixture and copper soda. They must be sufficiently insoluble

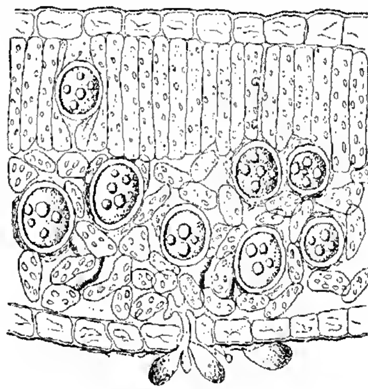


Fig. 2.

Downy Mildew—*Plasmopara Viticola.*

Section of a vine leaf, late in the autumn, showing the wintering form of the fungus, or oospores, buried in the tissue of the leaf.—After Viala.

to not be immediately washed off by rain and sufficiently soluble for each rain or dew drop to be able to dissolve a trace of copper. These preventive sprayings are capable of absolutely protecting the vine from damage, though in very wet localities a large number of applications may prove necessary. In districts of France where Mildew is not very severe, three sprayings are given; the first when the shoots are 6 to 8 inches long, the second after blossoming, and the third before the fruit changes colour. These may be called the standard treatments, but in very wet seasons additional ones are necessary. It is in this connexion that knowledge of the period of incubation becomes of great value. If Mildew spots are present in the oil-mark stage, they will not produce conidia (no white down will be visible) until rain falls. Should this

occur, and the white down appear, fresh contamination becomes possible unless the tissues have been protected by spraying. Any infection which does occur must incubate before it again reaches the oil-mark stage.

According to Professor Ravaz, the incubation period has a duration of seven days.* Spraying must not, therefore, be delayed beyond this period, but the nearer its execution to the fatal seventh day the more effectual will its protection prove.

Another question of considerable importance in deciding the best moment to spray is the receptivity, in other words, the liability of the vine to infection.† Much useful work has recently been done in issuing warnings as to when to spray, based on the co-ordination of meteorological data and receptivity. To the late Cazeaux-Cazalet must be given the credit of being the pioneer in this work, which he first undertook in 1895, in connexion with Black Rot, a totally different fungus. It was found later that similar methods could be applied to Mildew with almost equally satisfactory results.

In 1898, in collaboration with M. J. Capus, he undertook the warning of vine-growers in the neighbourhood of Cadillac, where he resided, by means of posters, as to the best moment to spray. These warnings proved so valuable that, at the request of vine-growers in neighbouring departments, who subscribed to defray the expense involved, several *stations d'advertissement*, or warning stations, were established. This work, which is under the direction of M. J. Capus, has been considerably extended during the past few years, with most valuable results. It is highly probable that similar investigations could with advantage be extended to other fungus parasites.

Without going fully into the rather complex method by which the proper time for warnings is determined, it may be briefly stated that receptivity corresponds with periods when vegetative activity slows down. This is usually due to a spell of cold weather, but, curiously enough, it may also be caused by the soil being too dry. Daily measurements of cane growth permit of its being ascertained; should it correspond with a falling barometer, or meteorological stations predict rain, spraying is opportune, and warning is given.

It must be remembered that any leaves and tips of shoots which grow subsequently to a spraying are quite unprotected. In dry weather this is of no consequence, but should moister conditions provide the drops of water necessary for germination, these new growths will become infected; seven days later incubation to the dangerous oil-spot stage will have occurred. Should rain again fall, the white down will appear in abundance, providing countless millions of spores, these will germinate, given a continuance of suitable wet weather—not without—on lower parts of the vine from which the protective spray has been washed by rain. Such defenceless tips are in this way a danger, especially to the young

* This duration of seven days of the incubation of the disease has this year shown no variation. It may thus be considered in practice to be constant. Hence, when there are live germs and a fall of rain takes place, one is forewarned as to what will happen. All there is to do is to take steps to check the invasion which will result from that which is already under way.—L. Ravaz, *Progres Agricole*, 12th August, 1917.

† In order that vegetable parasites may be able to invade the tissues of the vine two sets of conditions must be fulfilled. 1. Atmospheric conditions such as will permit spore germination. 2. Conditions connected with the growth of the vine which place it in a state of receptivity as regards diseases.—J. Capus, in *Progres Agricolé*, 26th March, 1911

bunches, on which they may cause grey rot early in the season, or brown rot later on, provided, of course, that weather conditions are favorable; once the berries commence to change colour the stomata are closed, and berry infection is no longer possible. The young bunches are somewhat difficult to protect with spraying mixture; being hidden under the leaves, this does not readily reach them; their waxy nature also causes it to adhere less satisfactorily than to the leaves. For bunch protection the copper-containing powders, to be described presently, are a very useful adjunct to sprayings—being cheaper, they can be more frequently applied, and by means of the bellows or knapsack sulphurer they can be blown into the centre of the vine, where the young bunches are situated.

Topping, to remove the unprotected tips, has been recommended; it often defeats the object by promoting the growth of laterals, which are just as dangerous. Nevertheless, in some cases it can do good, especially when an invasion is under way, but before the sporulation stage is reached—in other words, they must be topped less than seven days after the rain which permitted their contamination. Working the soil, by increasing air moisture, facilitates infection. Cultural operations, and likewise irrigation, should therefore be suspended whenever this is to be feared.

Winter Treatment Useless.

Though for both fungi preventive treatment can alone be depended on, Mildew differs greatly from Anthracnose, which can best be combated by the destruction of the resting stage in winter by the acid iron sulphate swab. For Mildew, however, no winter treatment is of the slightest use. The oospores of the fungus pass the winter in the soil embedded in the more or less decomposed remains of affected leaves, where they are beyond the reach of any treatment. It would obviously be futile to swab canes or stems on which no wintering forms of the fungus exist.

Spray Mixtures.

As regards copper sprays, either Bordeaux mixture or copper soda is good. The former is to be preferred, as it adheres better, and does not deteriorate so quickly after mixing. It is largely used by orchardists, but for vines it should be rather stronger than the usual orchard formula (6-4-50). It should be 6-4-30 for Bordeaux, or 6-8-30 for copper soda. The French way of mixing it is simpler than that usual here; and with it one can more easily obtain a neutral mixture. If not neutral, or nearly so, burning of the tender growths will result. Both lime and soda vary a good deal in composition, hence the system of weighing either of these substances does not always give satisfactory result.

The Commission recently appointed by the Société Centrale d'Agriculture de l'Herault to inquire into the disastrous Mildew outbreak of 1915 in France, reported on this phase of the subject as follows:—"We do not recommend any change in the usual preparation of *Bouillies* (copper-containing spray mixtures); we will only state that, whether it be a question of ordinary commercial (proprietary mixtures) or of wetting bouillies* that they must contain a sufficient proportion of

* Much attention has been paid to the wetting power of sprays; this can be increased by the addition of soap and several other substances.

copper to poison the spores, and that their bad preparation and bad quality do not render them inactive." Concerning the dose of copper sulphate, it says:—"Although formulæ at 1 per cent. have given good results to some growers, the Commission considers that for *Bouillie Bourguignonne* (copper soda) as for *Bouillie Bordelaise* (Bordeaux mixture) proportions of 2 per cent. and even 3 per cent (2 and 3 lbs. to 10 gallons) are to be most strongly recommended for violent invasions." Several of these well-known sprays are described, as well as Verdet (verdegris or copper acetate) and copper ammonia, but no mention is made of their having proved superior to the older mixtures.

Space will not permit further details here. The following will be found a simple method of preparing Bordeaux mixture:—

Weigh 2 lbs. of bluestone and dissolve in 5 gallons of water in a cask or tub in which the 10 gallon level is marked by a peg. Solution is facilitated by tying the bluestone in a small piece of hessian just below the surface. When dissolved, mix thoroughly with a wooden stick.

Take about 2 lbs. of quicklime, slake same in another tub with small quantities of water at a time, make up to 5 gallons with water, and stir thoroughly so as to make a thin milk.

Prepare the mixture, dipping out the milk of lime with a dipper and pouring it through a fine sieve into the bluestone solution,* carefully stirring. As soon as a couple of gallons have been thus added, test with testing paper, a small piece of which is dropped into the mixture. Usually, if the milk is thin enough, the first piece remains white; more milk is then added with thorough stirring. A second fragment of paper is added, and so on, until the paper becomes slightly pink, which indicates neutralization. There is now enough lime; make up to 10 gallons with water, and stir well. The rest of the lime may be thrown away.

After the first addition (2 gallons) of lime milk, stir very thoroughly —energetic stirring should likewise be given before each subsequent addition of lime. Cease adding lime as soon as the first symptoms of colour change are shown by the test paper. (The above applies to Phenolphthalein paper.) Litmus paper may also be used—it is red when acid, and blue when alkaline.

Another good indicator is a 10 per cent. solution of ferrocyanide of potash. So long as there is any unneutralized copper sulphate a few drops of the spray mixture added to a like quantity of this test solution in a saucer, turns it a deep brown colour—with this indicator cease adding lime as soon as this colour is no longer produced.

If either of the above indicators be used, it is not necessary to carefully weigh the lime; good fresh building lime is best for the purpose. If 2 ounces of sugar dissolved in a little water be added to every 10 gallons of the mixture, it will keep its power for some days. It is, nevertheless, better to use freshly prepared mixture.

A slightly acid mixture is generally preferred to one which is quite neutral or slightly alkaline. In order to obtain a slightly acid mixture proceed as above, but before pouring in the milk of lime withdraw half a gallon of the bluestone solution in an earthenware jug; this will be

* Care must be observed always to pour lime (or soda) *into the bluestone solution*; if the process be reversed, a different reaction takes place and the mixture is unsatisfactory.

..lded to the mixture after neutralization has been obtained, as shown by ..e test paper.

The above recipe may also be used for making copper soda mixture. All that is necessary is to substitute 3 lbs. of carbonate of soda (common washing soda, not baking soda) for the 2 lbs. of lime.

Copper-Containing Powders.

These were first proposed as substitutes for spraying—their chief advantage is facility of application, which is as great as in the case of ordinary sulphur. It was soon found that they do not adhere so well as sprays, and that, therefore, the protection they afford is insufficient. Nevertheless, they are a valuable supplement to sprays, especially in a wet season, when repeated treatment is necessary.

These powders are often mixed with sulphur, so that the same treatment may combat Mildew and Oidium. Several formulæ are put up under different proprietary names. Those suggested by Messrs. Skawinski may be taken as types. The following two are mentioned by R. Brunet in his recent work *Maladies et Insectes de la Vigne*:—

	Skawinski's powders. With sulphur. Parts by weight.	Skawinski's powders. Without sulphur. Parts by weight.
Sulphur	50	—
Copper sulphate	10	10
Lime	3	3
Coal dust	29	72
Alluvial soil, burnt and ground	8	15
	100	100

Concerning the use of these powders the Commission previously referred to reports:—

"The effects of cupric powders have been very variable. The Commission is of opinion that, though these powders can in ordinary seasons give very good results for the defence of bunches and leaves, in a grave invasion like that of 1915 they must only be looked upon as *supplementary treatments*.

Their efficacy is greatest when the vines are enveloped in fog.

They must be used in abundance, treating each vine twice consecutively on each side and giving, each time, a puff with the bellows, inside the vine, so as to reach the branches."

* * * * * *

From the above it will be seen that the fungus which has recently appeared in our vineyards is of a most dangerous nature—given suitable climatic conditions, of course. In normal summers we have probably as little to fear as California or the Cape, but last season was far from normal, and, so far, the present one is proving even wetter.

Forewarned is forearmed: to ignore the menace might mean courting disaster.

Though visitations such as would necessitate the almost weekly sprayings sometimes needed in France are not to be feared here, the

disease may do harm in a wet summer. Should weather conditions conspire to permit bunch contamination, which is far from impossible, grave damage might result. That spray protection will prove much more efficient here than in France can confidently be promised. It is hoped, therefore, that growers will familiarize themselves with the usual methods of treatment outlined above, keep a sharp look out for the first appearance of the disease, and above all, make arrangements to secure without delay, should occasion arise, the necessary outfit and materials.

Delays are always dangerous; with this particular fungus they might prove fatal to the crop.

UNDERGROUND DRAINAGE AND ITS BENEFITS.

By T. H. Grass, Potato Inspector.

Underground drainage serves to relieve the land of free water, which is harmful to most plants if left to stagnate in the earth near the surface. This serves, not only to dry the land in early spring, but indirectly to warm it, for, if the water be removed, the heat of the sun warms the soil instead of cooling it by evaporation of the surplus water.

If much of the free water in spring-time be carried through the soil by under drains, then the superabundant water of mid-summer will, in like manner, be removed. The rain in the spring-time is warmer than the soil, and if it percolates through the land to the drain, it parts with its heat and indirectly warms the soil, while the rain in the summer is cooler than the soil, and in passing down to the drains cools the land. Under drainage prevents the small channels of the soil from becoming blocked or filled with fine particles of earth held in suspension, that is, it prevents puddling to a great extent. Clayey soils shrink if they become dry, and swell when wet. Under drains tend to prevent the swelling and closing of pores which have been produced by drying.

As soon as air is admitted to the subsoil, the dead roots of plants are decomposed and minute channels are formed in the soil which prevent the formation of large cracks that admit the air too freely, and thereby cause excessive evaporation. Under drains also promote fertility by opening up the soil to the oxidizing action of the air, and by making the soil more suitable for the nitrifying organisms. The more water that can be made to pass through the land in a reasonable time the better, for in passing through the ammonia is taken up by the soil, which thus becomes better aerated and more friable, and decomposition of organic matter is hastened, plant food of all kinds is liberated, and the productive power of the land is increased in many other ways. Underground drainage increases the fertility of the soil and prevents or mitigates some of the diseases.

Fields thoroughly drained suffer less from droughts than those which are undrained.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

Spraying.

The spray pump should now be in thorough working order, so that the various spring sprayings may be carried out with as little interruption as possible. It is always wise to clean out the pump after each spraying, so that it will be ready for the next mixture. Putting a different spray in a pump barrel that has not been washed out, very often causes the formation of a sediment, which blocks the nozzle and interrupts the work.

During November it will be necessary to spray for codlin moth, peach aphis, pear slug, and various leaf-eating insects. In addition, black spot of the apple and pear, shot hole, and other fungus diseases must be kept in check. As various sprays are required for all of these troubles, the necessity of always having a clean pump is evident.

At the present time the best spray for peach aphis is strong tobacco solution, and the same spray may also be used for the pear slug. Arsenate of lead is the better spray for this latter insect, but it should not be used when the fruit is approaching the ripening stage; hellebore may also be used for the slug with good effect.

As a preventive against codlin moth, the trees should be kept well sprayed with arsenate of lead. If the spraying is careful and thorough, no bandaging need be carried out. The time spent in bandaging could be far better employed in an extra spraying. The first spraying should have been given at the time of the falling of the petals; the second spraying, owing to the rapid expansion of the fruit, should be given a fortnight later. After that the grower must use his own judgment as to the necessity for subsequent sprayings. If the moths be at all prevalent, other sprayings will be quickly necessary.

As the woolly aphis is increasing at this time of the year, it will mean a saving of a large number of buds if this insect be sprayed. Nicotine solution, pine spray, or lime sulphur may be used with good effect.

Cultivation.

The work of ploughing and harrowing should be completed immediately. All crops for green manure should be now under cover, and if the orchard soil is at all heavy or stiff, the grower should make up his mind to grow a crop next season, in order that this condition may be reduced.

The orchard should be kept free from weeds, not only for the conservation of moisture, but in order to do away with all hiding places of the Rutherglen fly, cutworm moths, &c.

General Work.

Grafted and newly-planted trees should be frequently examined, and given an occasional watering and overhead spraying, in order to encourage their growth, and to prevent loss of moisture from the foliage.

It is also advisable to mulch young trees with light grass, or straw mulching not too rich in animal manure.

The disbudding of unnecessary shoots and the pinching back or stopping of growths, to prevent their becoming unduly long, may now be carried out. This work is particularly important on young trees.

Graft ties should be examined, and the ties cut wherever any growth is being made. Where the grafts are likely to make any long growth, they should be well staked and tied.

Citrus trees may be planted out, and, after planting, they should be watered and mulched.

Vegetable Garden.

Tomato plants should now receive attention every day; laterals will require pinching back; crowded bunches and shoots should be thinned; the plants should be well tied to the stakes, and liberal supplies of water and manure should be given. One or two more plantings of tomato plants may still be made, so that there may be strong, sturdy plants for the production of late fruits. By planting three or four successions of plants, it is possible to have a good supply of fruits from December to June.

Celery may now be sown for winter crops. French beans should be largely sown. Cucumber, melon, pumpkin, and all seeds of this family may now be sown in the open.

Where these plants are already growing, the longest and strongest runners may be pinched back, to throw the strength into flowering and lateral growths. Watch the plants for mildew, and use sulphur freely wherever present, especially on the young plants.

Peas, lettuce, radish, turnip, cabbage, and sweet corn seeds may be sown this month. Seedlings from former sowings may be planted out, and it would be well to dip the whole plant in water before planting. This greatly assists the young plants while taking hold of the soil in their new location.

Frequent waterings and frequent cultivation will now be necessary; and all weeds must be hoed or hand-weeded out; mulching with stable manure will greatly assist the plants.

A few beds should now be deeply worked, adding a liberal dressing of stable manure. These plots will then be ready for the celery, cabbage, and other seeds planted during this month.

Flower Garden.

Continue to plant out the various bedding and foliage plants, corms of gladoli, tubers of dahlias, and seed of such tender annuals as phlox Drummondi, balsam, zinnia, nasturtium, celosia, aster, cosmos, and portulaca.

While seeds planted out in the open germinate and grow fairly well, it is advisable during the summer months to plant these in sheltered seed beds, or in a canvas or calico frame. The protection need be on the one side only, preferably the west or north-west; the seedlings are then protected during the hottest part of the day. At the same time the shading should not be sufficient to unduly "draw" them.

The seeds should not be deeply sown, and all waterings should be light. A little water, often, should be the rule for seedlings. Annuals require plenty of room when planted out in the garden. Being quick growers, they are generally gross feeders, and they must have space to develop a good root system. Feeding, too, with liquid manure is helpful when they are reaching the flowering stage.

Dahlias should now be planted out, either from tubers or from young rooted cuttings. These will give good summer blooms. For autumn and show blooms, the planting should be deferred until the middle of December.

Herbaceous and succulent plants should be staked for protection; included in this section are delphinium, gladiolus, perennial phlox, rudbeckia, &c. These plants will all benefit from liberal mulchings and watering with liquid manure when approaching the blooming period. Spring flowering bulbs, corms, and tubers should now be lifted and stored.

The soil surfaces will now benefit from frequent hoeings and stirrings. Constant waterings will be required if the weather be hot or windy, the cultivation should quickly follow the waterings in order that the moisture may be thoroughly conserved. Mulching with stable manure is also beneficial at this season.

REMINDERS FOR DECEMBER.

LIVE STOCK.

HORSES.—All farm horses in constant work at this season should be well fed with last year's chaff or a mixture of old and new, to which a liberal supply of oats has been added. New chaff or hay alone is not recommended, as it has not the sustaining powers of old hay, and is liable to give rise to digestive troubles. Horses require water at frequent intervals; keeping them for a long time without water, and then allowing them to drink to excess is injurious.

An occasional feed of green stuff will be beneficial. In the event of this being unobtainable, give at week-ends a bran mash, to which is added five or six packets of Epsom salts.

Mares which are away from foals for any length of time should have a portion of milk taken from them before foal is allowed to run with them, otherwise serious results may accrue to foal. Good results follow an allowance of chaff and oats to mares and foals running in paddocks, more especially where feed is short.

At this season the Bot Fly is about, and horses should be frequently examined for the eggs of this fly. The neck, forelegs, and jaws are the parts where the eggs are deposited. Either the use of the singeing lamp under affected parts or the application of kerosene will destroy the eggs.

CATTLE.—Provide succulent fodder and plenty of clean water and shade. Limewash the cowbails, it helps to keep down flies. Provide "lick" in trough, consisting of salt 20 lbs., bone meal 20 lbs., and sulphate of iron, ½ lb. Look out for milk fever. Read up method of treatment in *Year-Book of Agriculture*, June, 1905. Have cows' milk weighed, and tested for butter fat. Rear heifer calves from cows giving satisfactory results. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Give half-a-cup of limewater in

the milk to each calf. Let them have a good grass run or lucerne, or ½ lb. crushed oats each per day in trough. Dehorn all dairy calves, except those required for stud or show purposes.

PIGS.—*Sows.*—Supply those farrowing with plenty of short bedding in well-ventilated sties. Those with litters old enough may be turned into grass run. All pigs should be given a plentiful supply of clean water. Read Bulletin No. 16. Pig raising and fattening with present price of pollard and bacon should be highly profitable.

SHEEP.—Mate all good young ewes procurable. Fatten and dispose of all broken-mouthed, inferior-fleeced, and very coarse-woolled sorts. Where ewe lambs are intended to be held for future breeding, see that the cross results in shafty, fine to medium grade fleeces, as well as a shapely frame. Allow rams to remain with the ewes seven weeks, this period admitting of any ewes coming in season the second time. It is rarely necessary to join more than 3 per cent. of 2 tooths, 3 per cent. of 5 and 6 year olds, or 2 per cent. of 2, 3 and 4 year old rams, unless with young ewes. If conditions justify it, 4 per cent. of vigorous matured rams with aged coarse crossbred ewes will bring a greatly increased number of twin lambs. Clear wool and burrs from about the pizzles of rams, and cut hoofs into shape before mating. Ewes should be of one breed, or as near one cross as possible, to ensure an even and rapid dropping. Merino and fine cross ewes are in season earliest, first cross or half-breds later, and all ewes with a preponderance of British blood later still. Ewes carry their lambs four months, four weeks, four days, or roughly, five months.

POULTRY.—Add a little peameal to morning mash and give less bran. Feed equal parts wheat and heavy oats at night. Supply plenty of green food—at this time, lettuce is invaluable. Discontinue salts and condiments. Avoid salt meat of any description. Put Douglas mixture in drinking water when required. Keep ample supplies of sand, ashes, &c., in pens, and moisten same. This will enable the birds to keep themselves cool and clean. Top off geese, ducks, and cockerels for the Christmas markets. Hens will do better this month by having free range. Remove all male birds from flocks, as infertile eggs will keep longer and command a higher price.

CULTIVATION.

FARM.—Cut hay in late districts. Cut oats and barley in early places. Finish planting potatoes. Put in late maize for fodder, also millet and imphee. Plough fire-breaks where required. Get stackyard and stages ready for hay.

ORCHARD.—Keep the surface loose and free. Suppress weeds. Spray as often as necessary for codlin moth and pear slug. Mulch and spray young trees and grafts with water in the early morning during hot weather.

VEGETABLE GARDEN.—Keep the surface hoed, and allow the plants plenty of moisture. Stake, pinch out, manure, and water tomatoes. Pinch back long runners of pumpkin and melon family. Sow autumn and winter varieties of cabbage and cauliflower. Plant out seedlings in cool weather. Sow French beans. Cease cutting asparagus beds, and top-dress with manure.

FLOWER GARDEN.—Plant out dahlias and gladioli for autumn blooming. Lift and store spring flowering bulbs. Stake, tie, and train growing plants. Sow zinnias and asters. Layer carnations, camelias, daphnes, &c. Water well and keep the surface loose. Keep rose beds fairly dry.

VINEYARD.—Inspect young grafted vines (field or bench); suckering and removal of scion roots should be carefully attended to—See *Journals* for September and October, 1917. Tie up young vines. Beware of cut worms on young vines—See *Journals* for July, 1911, and September, 1913. Tying up of bearing vines, if practised, should be completed early in month. Avoid excessive and indiscriminate topping, far too frequent in Victoria. Scarify, if soil is not sufficiently loose, and after heavy rain or irrigation. Look out for oidium and repeat sulphurings on first appearance of disease. Keep a sharp look-out for Downy Mildew—See article in current issue.

Cellar.—Fill up regularly and keep cellars as cool as possible.

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FLUKE IN SHEEP.

(1) STRUCTURE AND LIFE HISTORY.

By Georgina Sweet, D.Sc.

Structure.

The common liver fluke (*Fasciola hepatica*), one of the best-known of all parasites, is a flat worm belonging to the group *Trematoda*. It lives adult in the bile-ducts of the sheep chiefly, also commonly in the ox, and less commonly in rabbits. It has also been found occasionally in the goat, hare, and kangaroo, and even in the pig and horse, and at times in human beings.

The parasite is leaf-like in shape, pointed posteriorly, and with a triangular head end. It has two suckers, one at the extreme anterior end, containing the mouth, the other larger and non-perforate on the under surface near the base of the head-lobe, and serving as a means of attachment to the walls of the cavity in which it lives.

The body is yellowish-white to greenish-grey in colour, and is enclosed in a thin, but very resistant, "skin" or cuticle, covered with tiny spines, which are largely responsible for the effects produced by the flukes on the liver of the host.

The digestive system consists of a strong muscular pharynx or sucking-bulb following the mouth, and a much branched and capacious intestine, in which the bile, mucus, and blood taken from the host are digested. The reproductive organs of the fluke are hermaphrodite and very complicated. They are admirably adapted for the production, under all conditions, of the enormous number of eggs—probably many tens of thousands—laid by each fluke. This large number of eggs compensates in some measure for the many chances against any one egg escaping destruction and fully completing its development into a mature individual.

Life History.

The eggs are very small (about 1-180th of an inch long), ovoid, and enclosed in hard shells with a lid at one end. They are discharged by the

bile duct into the intestine of the host, and thence to the exterior (generally about February). Here, if the necessary conditions of moisture and moderate warmth (about 77° Fahr.) are present, the embryo begins to develop within the egg shell. From the latter there escapes in about two or three weeks' time a tiny conical ciliated larva with a small papilla (or boring apparatus), at the broad anterior end. The lower the temperature the more slowly do the eggs hatch out, but apart from this, eggs laid at the same time vary considerably in the period required for hatching. This fact is of much practical importance, since damp ground over which eggs have been scattered may be dangerous for a long period independent of temperature conditions.

This ciliated larva swims about in the water or moisture until it meets with a particular species of fresh-water snail, but it dies if it fails to find this new intermediary host within a few hours (generally eight). The embryo usually bores its way into the breathing chamber of its snail host, and then undergoes development, first into a shapeless sac—the sporocyst—this stage being reached by the end of a fortnight in warm weather.

Within this sac another generation is produced known as the Redia, which is more complicated than the very degenerate sporocyst from each of which some five to eight Rediæ burst their way out. The Rediæ leave the breathing chamber in which they are formed, and force their way into various organs of the snail, especially into the liver, causing thereby considerable injury to the snail tissues, so that a moderately heavy infection will soon kill the snail.

The Rediæ may reach a length of 1-18th of an inch, and has a simple alimentary canal by which it digests the liver cells of its snail host. Within the Rediæ are formed (1) daughter Rediæ, especially in summer-time, and also (2) a third generation known as the Cercaria, to the number of from twelve to twenty. A fall of temperature seems to hasten the formation of the Cercariæ. The fully-formed Cercaria escapes by a birth-opening from the Redia, and can move about very rapidly in moisture by its suckers or tail, as the case requires.

Usually the body of the Cercaria is about 1-80th of an inch in length, oval or heart-shaped, and with a long contractile tail. It has two suckers, one oral, the other ventral, a simple forked intestine, and certain cyst-forming cells. These Cercariæ usually leave the body of the snail and swim about for a while in the water, but soon they begin to enclose themselves in a tiny snow-white cyst on leaves of grass or other substances in the water, the tail being cast off. (In Australia some types of Cercariæ become encysted within the snail-host, evidently an extra provision against drought conditions. Whether the Cercariæ of the liver-fluke does so also is not known, though it is probable.) Should this cyst be eaten by a sheep or other herbivorous animal, either on grass or within the snail, the cyst wall is dissolved in the stomach of this new final host, and the Cercaria or young fluke is set free.

It was formerly thought to wander up the bile-duct, and so into the bile passages in the liver, but recent investigations prove that, in many cases at least, invasion of the liver takes place by means of the circulatory system after the setting free of the young fluke in the stomach, *e.g.*, flukes have been found in the liver of unweaned lambs and calves, and

[illegible]en in a fœtus, and in the heart and large blood vessels of adult animals [illegible]nd man.

Infection of the sheep generally occurs in mid and late winter, deaths [illegible]ccurring from January to September of the following year. At the [illegible]nd of some six to twelve weeks the fluke is able to produce eggs, making the whole life-cycle possible in a minimum of thirteen weeks in a wet [illegible]ummer—and it has been shown that flukes may retain their full vigour at least thirteen months, and, perhaps, up to three years.

The species of snail necessary as an intermediary host varies in different countries—thus, in Europe, it is *Limnæa truncatula*, as proved definitely by the classical feeding experiments of Thomas and Leuckart, and *Limnæa peregra*, also as shown by Leuckart. In some countries, other species of Limnæa, and perhaps, other genera, are implicated. In Australia, although Rediæ and Cercariæ, from a number of species belonging to several genera of fresh-water snails, are known and recorded, there is no record of any feeding experiments yielding positive results, such as are essential to finally prove the exact relationship of these Rediæ and Cercariæ to the life history of *Fasciola hepatica*.

We are, therefore, still unable to say with certainty which species is the intermediary host of the common liver-fluke, although undoubtedly it is some species of small fresh-water snail, probably *Bulinus tenuistriatus*, *B. brazier*, and *Ancylus tasmanicus*, as the observations of Cherry, Fielder, Cobb, and others suggest.

It may be readily understood that there are many chances against any one egg completing its life cycle, but the large number of eggs produced by each fluke (45,000 as a minimum), the power possessed by the eggs of remaining dormant for months if they fall on dry soil, the increase in number of individuals in each generation within the snail host, the very considerable resistance of snails, even of some fresh-water snails, to partial or temporary desiccation, and the fact of encystment on grass or in the snail, are all factors of much importance in enabling the fluke to evade untoward conditions.

It will be seen from the preceding sketch of the life history of the fluke, that the conditions for propagation of the disease in any area are (1) the presence of eggs of the fluke, (2) wet, swampy or marshy ground or pools, or slow streams, in which the eggs hatch, (3) the presence of the intermediary snail host in the area, and (4) the presence of sheep or other herbivorous mammals, which may swallow the encysted parasite and so become infected, and in which the fluke may reach sexual maturity.

(2) THE EFFECTS OF FLUKE ON THE LIVER.

By H. R. Seddon, B.V.Sc.

As mentioned by Dr. Sweet in the preceding section of this article, infection of the liver may, apparently, take place in two ways. These are by the young flukes (1) passing from the intestine up the bile duct to the liver, or (2) getting into the portal blood circulation from the stomach, and so being carried to the blood vessels in the liver. The former has been previously thought to be the common method here, but it would appear that the latter (infection through the blood circulation) has certainly taken place in the particular type of the disease observed in Victoria this year.

The appearances in the liver vary so much according to the presumed method of infection that it will be better to describe the lesions under two headings.

(1) Ordinary Appearance of Livers Affected with Fluke.

In this it would appear most probable that infection has been by way of the bile duct. The presence of flukes in the bile ducts causes a chronic inflammatory condition resulting in marked enlargement of the ducts, and, at the same time, great thickening of their walls. The left lobe is frequently more seriously affected than the right, and very commonly the left lobe alone is found affected.

The affected part of the organ usually appears shrunken, and the surface is often irregular, due to the presence beneath the capsule of the thickened bile ducts, which may be felt as hard cords, and which give rise to the term "pipy" liver.

On cutting into the organ the great changes in the bile ducts may be readily observed. They are dilated, and their walls thickened with white fibrous tissue. The lining membrane of the ducts may be red and inflamed, but more often it is dark in colour and is sometimes calcified. The bile ducts contain brownish, glairy fluid, flukes and their eggs.

Not only is there an increase of fibrous tissue around the larger ducts, but also around the smaller, even down to the smallest, which makes affected portions of the liver paler and harder than normal.

(2) Type of the Disease which has been so prevalent during the past Year.

In this, as mentioned before, infection seems to have been by way of the blood. These cases are acute—not chronic like the ordinary type of fluke disease. In the great majority of them the whole liver is affected, and on this account, and also owing to the fact that the parasites are in the blood vessels and occasionally in the actual secreting tissue of the liver, this type of the disease is much more serious. The flukes found in such cases are never very large—sometimes, in fact, they are only with great difficulty discovered with the naked eye. At the same time, they are often very numerous, and produce much irritation, as is evidenced by the greatly altered appearance of the liver and by the fact that the condition so often causes death of the animal.

The liver, in these cases, is best described as *mottled*, there being greyish, yellowish, greenish, and blood-red areas thickly scattered through it, while the capsule or covering of the liver is somewhat thickened and roughened. There is not, in the early stages, any marked fibrous condition of the organ, and the bile ducts do not stand out prominently as in the common chronic form. A few very small flukes may be squeezed out on pressing a cut surface. These are usually mixed with a quantity of reddish pus-like material, and lie in irregular cavities in the organ. Microscopically, we find that the chief changes are in the vessels (portal veins) and in the secreting liver tissue, to which latter the parasites often escape from the vessels. The majority of these parasites are usually dead, but even in that state produce a considerable amount of inflammation. The blood vessels of the liver, as is to be expected, show inflammatory changes, which, interfering with their function, produce serious effects on the liver tissue.

On account of the softness of the liver, rupture sometimes occurs, especially through violent exercise or rough treatment by dogs, &c., during yarding operations.

In such circumstances, death does not necessarily take place, the animal, perhaps, recovering after showing symptoms of severe illness for a few days.

When only portion of the liver is affected, the tendency is for the disease to become chronic. In this stage portions of the liver will appear tough, white, and fibrous.

(3) SYMPTOMS AND TREATMENT.

By W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer.

During the past two years fluke has been very prevalent in both cattle and sheep, but more particularly in the latter, and it has been extremely difficult to find a liver at the abattoirs that was not affected. Many deaths throughout the State were undoubtedly attributable to fluke, some of them in districts usually free from the disease.

In order to put the subject before sheep-owners as completely as possible, Dr. G. Sweet, of the University Biological School, was invited to prepare a short article on the life history of the parasite, and Mr. H. R. Seddon, B.V.Sc., of the University Veterinary School, has written on the pathological appearance of specimens that were submitted to him for examination. I have to thank both these writers for the foregoing portion of this article.

A large number of lambs, in good condition, in which the only observable lesion was that described by Mr. Seddon as being present in the liver, were lost. Practically no symptoms of sickness were noticed—the animals being found dead in the paddocks or collapsing suddenly during yarding operations. This seems to indicate that the heavy invasion of fluke induces a condition of the body which cannot withstand any heavy exertion without fatal results.

In an ordinary infestation, such as is known to most stock-owners, no symptoms are perceptible in the early stages. As the fluke develops, however, dulness may be observed, weakness gradually becomes apparent, and the animal falls away in condition. Closer examination may show the white of the eye to be abnormally pale, as also the skin; the wool is brittle and easily pulled out. Soft, doughy swellings may appear under the throat and brisket—a condition often known as "bottle-necked." The animal becomes progressively weaker, lies about by itself, is, perhaps, affected with diarrhœa, and finally dies from exhaustion.

Treatment.

Medicinal treatment for curative purposes has, up to the present, been unsatisfactory. This is not surprising when it is realized that the young flukes are imbedded in the small ducts or tubes of the liver, and a drug to affect them must be absorbed into the blood stream and carried to the liver, and there excreted. During the passage through these channels drugs are considerably changed in their character, and the difficulty is to find one poisonous to the fluke but not powerful enough to destroy the tissues of the liver.

A special etheral extract of male fern has recently been prepared by a firm in France for which highly satisfactory results are claimed, but so far it has not been tried in this country. At the same time, there are three factors which will operate against its use amongst other than stud

stock—(1) the price of a single dose in France is sixpence, and five doses must be given; (2) the drenching of a mob of some hundreds of sheep every day for five days would be a task that could not be undertaken by the majority of owners, and (3) fatal results are, on occasion, attributable to its administration.

Preventive measures are, however, possible, and it is to this line of treatment we must look for relief. One of the surest ways to open the animal system to invasion of any parasite is to reduce the condition and lower the vitality. Sheep that are of robust constitution will fight against the invasion and withstand the effects of fluke to a far higher degree than those weakened by poverty and bad management. This fact should be borne in mind, and, whenever possible, debilitated animals kept away from paddocks known to be "fluky."

The constitution of all sheep should be built up and their systems put into a condition capable of withstanding invasion. Experience has shown that this may be effected by providing licks, of which a large number are on the market. One which has proved very efficacious is composed of lime and salt, 20 parts each; superphosphate and sulphate of iron, 5 parts each. Another is simply salt worked into a sticky mass with Stockholm tar (about 1 pint to 1 cwt.) Any lick used should be placed in shallow troughs protected from the weather, and easily accessible to the sheep. There is no doubt that, in addition to any improvements the use of licks may have on the constitutions of a flock, the salts will have a destructive influence upon the encysted Cercariæ when taken into the stomach.

Study of the life history of the parasite reveals another and equally important channel in which to attack the problem. It is absolutely necessary, in order that the various stages of development may be passed through, for the intermediary host—the small fresh-water snail—to be present. Fluke cannot be transmitted from sheep to sheep. Therefore, if we can break the life cycle at any point, infection will be checked. And this, perhaps, can be done most effectively by freeing paddocks from stagnant water and by the destruction of the snail host.

Fluke is practically unknown on high lands with good natural drainage, whilst on low-lying, wet flats it is impossible, in many cases, to rear sheep. The first method of attack is, therefore, revealed by nature; provide sufficient drainage and remove all stagnant water. This will mean that there will be a greater chance for the destruction of the egg in the first place, and a lessened chance of entrance to the snail host, the number of which will also be reduced on well-drained land. Then keep the pasture on low-lying land as free from harbors for the snail as possible; destroy old tussocks and the like; top dress the pasture to encourage a growth of succulent herbage, which will be kept well cropped by the stock. A heavy dressing of lime will have a very beneficial effect in stimulating the grass, and will also destroy large numbers of the snail. A top dressing of salt has even been used in some cases, but if it be used to excess it will have a deleterious effect upon the grasses.

To summarize, all our present knowledge points to the following line of treatment:—

Drain the pastures.
Keep sheep off pasture with water lying about.
Destroy the snail.
Build up the constitution of the sheep.

VICTORIAN GRASSES.

By J. W. Audas, F.L.S., Assistant, National Herbarium, Melbourne.

There are about 136 species of grasses arranged under 49 genera native to Victoria and they are fairly well distributed over the State.

The accompanying table shows the distribution of indigenous Victorian genera, and their relative strength in species, over the various States of the Commonwealth.

Genera.		Western Australia.	South Australia.	Tasmania.	Victoria.	New South Wales.	Queensland.	Northern Australia.
Panicum	..	9	16	..	15	31	45	35
Chamaeraphis	..	1	1	..	2	2	2	1
Isachne ..	..	..	..	..	1	1	2	..
Oplismenus	..	..	..	..	1	1	1	..
Setaria ..	..	4	3	..	4	4	2	4
Spinifex ..	..	2	2	1	2	2	3	2
Tragus ..	..	..	1	..	1	1	1	1
Neurachne	..	2	3	..	3	3	1	1
Zoysia ..	..	..	..	1	1	1	1	..
Imperata	..	1	1	1	1	1	1	1
Pollinia ..	..	1	1	..	1	1	4	4
Lepturus	..	1	2	..	2	2	1	..
Hemarthria	..	1	1	1	1	1	1	..
Andropogon	..	6	6	..	8	11	13	9
Chrysopogon	..	1	1	..	2	2	4	4
Sorghum	..	2	..	..	2	2	3	3
Anthistiria	..	3	3	..	2	3	4	4
Alopecurus	..	1	1	1	1	1	1	..
Tetrarrhena	..	1	..	3	3	1	..	..
Microlæna	..	1	1	2	1	1	1	..
Hierochloe	..	..	..	2	2	2	..	..
Aristida ..	..	2	6	..	6	8	18	3
Stipa ..	..	14	10	6	13	10	10	1
Dichelachne	..	2	1	2	2	2	2	..
Pentapogon	..	..	1	1	1	1	..	..
Amphipogon	..	5	1	..	1	1	1	1
Pappophorum	..	1	1	..	1	1	1	1
Sporobolus	..	3	4	1	3	6	6	4
Agrostis ..	..	1	2	2	3	3	1	..
Deyeuxia	..	3	4	7	7	7	3	..
Deschampsia	..	..	1	1	1	1	..	..
Trisetum	..	..	..	1	1	1	..	..
Anisopogon	..	..	..	..	1	1	1	..
Danthonia	..	4	4	3	6	7	2	..
Cynodon	..	1	3	..	1	2	3	2
Chloris ..	..	3	6	..	2	4	8	6
Eleusine ..	..	2	2	..	1	4	6	4
Poa ..	..	6	4	3	4	3	2	1
Glyceria ..	..	3	4	2	5	4	3	1
Diplachne	..	3	3	..	2	2	2	3
Triodia ..	..	2	3	..	1	3	4	5
Distichlis	..	..	1	1	1	1	..	..
Bromus ..	..	1	1	..	1	1	1	..
Eragrostis	..	9	13	..	7	13	19	11
Elythrophorus	..	1	1	..	1	1	1	1
Trirhaphis	..	3	3	..	1	1	2	2
Agropyron	..	1	3	3	3	3	1	..
Arundo ..	..	1	1	1	1	1	1	..

Amongst the most valuable and nutritious grasses from a stock-raising point of view, the following may be taken as examples:—Fifteen species of *Panicum,* all of which are splendid fodder grasses, including the well known Umbrella Grass; eight of *Andropogon,* including the famous "Blue Grass" and other excellent grasses; seven of *Deyeuxia,* which include some good pasture grasses; seven of *Eragrostis,* some of which are remarkable for their drought-resisting qualities; four of *Glyceria,* including the Giant Mountain Grass; two of *Anthistiria,* which are colloquially known as Kangaroo and Oat Grass respectively; two of *Chloris,* including the Windmill or Star Grass; two of *Diplachne,* one of which thrives well in moist situations; four of Poa, one of which would be of use in the manufacture of fibre; three of *Sporobolus,* one of which would prove serviceable for paper-making. There are several species of the following genera:—*Cynodon* (Couch Grass), *Microlæna* (Weeping Grass), *Pollinia* (Brown Top), *Setaria* (Pigeon Grass), *Pappophorum* (Nigger Head), *Festuca* (Fescue Grass), *Eleusine* (Finger Grass), *Trisetum* (Spiked Oat Grass), *Eriochloa* (Woolly Grass), *Deschampsia* (Tufted Hair Grass), *Anisopogon* (Oat Spear Grass), *Amphipogon* (Bearded Heads), *Agropyrum* (Common Wheat Grass), *Alopecurus* (Bent Foxtail Grass), *Hierochloe* (Scented Holy Grass), *Dichelachne* (Plume Grass), *Arundo* (Reed Grass), and *Tetrarrhena* (Wire Grass).

Undesirable Grasses.

The most objectionable grasses native to Victoria belong to *Stipa elegantissima, S. flavescens, S. teretifolia, S. eremophila, S. setacea, S. Luehmanni, S. acrociliata, S. McAlpinei, S. Muelleri, S. semibarbata, S. pubescens, S. aristiglumis, S. scabra.* (The Stipas are commonly known as Spear Grasses.) Another genus is the *Aristida,* comprising *A. arenaria, A. Behriana, A. leptopoda, A. vagans, A. ramosa, A. calycina.* (These *Aristidas* are known vernacularly as Three-awned Spear Grasses.) A very objectionable grass is the False Spinifex, *Triodia irritans,* which is dreaded mostly on account of its sharp-pointed leaves. Although the number of indigenous undesirable grasses in Victoria does not exceed twenty, in some places they cover large areas, and depreciate their stock-carrying capacity.

Pasture Grasses.

The following are most useful for general pasturage:—*Andropogon pertusus,* "Pitted Grass"; *A. affinis,* "Crown Beard Grass"; *A. refractus,* "Turpentine Grass"; *A. sericeus,* "Silky Blue Grass"; *Agropyrum scabrum,* "Common Wheat Grass"; *Anthistiria imberbis* "Kangaroo Grass"; *Chloris truncata,* "Windmill Grass"; *C. acicularis,* "Lesser Star Grass"; *Cynodon Dactylon,* "Indian Couch Grass"; *Danthonia penicillata,* "Wallaby Grass"; *Dichelachne crinita,* "Long Hair Plume Grass"; *Eleusine cruciata,* "Finger Grass"; *Eragrostis Brownii,* "Common Love Grass"; *E. pilosa,* "Soft Love Grass"; *Microlæna stipoides,* "Weeping Grass"; *Panicum decompositum,* "Umbrella Grass"; *P. divaricatissimum,* "Spider Grass"; *P. effusum,* "Hairy Panic Grass"; *P. gracile,* "Slender Panic Grass"; *P. leucophæum,* "Cottony Panic Grass"; *P. Mitchelli,* "Spreading Panic Grass".

For Moist Soils.

The native grasses which thrive best in moist soils are:—*Glyceria fluitans*, "Manna Grass"; *G. Fordeana*, "Sweet Swamp Grass"; *G. ramigera*, "Bamboo Grass"; *Hemarthria compressa*, "Mat Grass"; *Imperatà arundinacea*, "Blady Grass"; *Panicum melanthemum*, "Black Seeded Panic Grass"; *Arundo phragmites*, "Common Reed Grass"; *Microlæna stipoides*, "Weeping Grass"; *Isachne australis*, "Swamp Millet"; *Diplachne fusca*, "Brown Beetle Grass"; *Danthonia nervosa*, "Swamp Wallaby Grass."

Grasses Suitable for Dry Situations.

The best native grasses for dry situations are *Amphipogon strictus*, "Bearded Heads"; *Anisopogon avenaceus*, "Oat Spear Grass"; *Echinopogon ovatus*, "Hedge Hog Grass"; *Eragrostis lacunaria*, "Mallee Love Grass"; *Neurachne Mitchelliana*, "Mitchell Mulga Grass"; *Pappophorum nigricans*, "Nigger Head," "*Pollinia fulva*, "Browntop"; *Chloris truncata*, "Windmill Grass"; *Eleusine cruciata*, "Finger Grass"; *Panicum effusum*, "Hairy Panic Grass"; *P. prolutum*, "Pallid Panic Grass"; *P. decompositum*, "Umbrella Grass."

Coast Sand Binders.

The following are most suitable for growing on sandy wastes adjacent to the coast:—*Distichlis maritima*, "Salt Grass" *Imperata arundinacea*, "Blady Grass"; *Festuca littoralis*, "Coast Fescue"; *Spinifex hirsutus*, "Hairy Spinifex"; *Sporobolus virginicus*, "Virginian Rat-tail Grass": *Zoysia pungens*, "Prickly Couch Grass"; *Hemarthria compressa*, "Mat Grass"; *Cynodon dactylon*, "Indian Couch Grass."

Pastures in their Present Condition.

A rich, succulent and varied character of indigenous grasses and forage plants cover the grazing lands during spring and summer, but during winter—when the weather conditions are unfavorable—the want of green succulent herbage is usually felt. One of the most widely diffused grasses is *Danthonia penicillata*, "Wallaby Grass." This perennial grass is found in nearly all open country, and in some localities it is the principal fodder grass, and being of a very nutritious quality, stock of all kinds relish it. *Anthistiria imberbis*, "Kangaroo Grass," is common in many places, and grows to a great height when left unmolested for a time. A peculiarity of this grass, and one which hinders its multiplication seriously, is the fact that it bears in its large ornamental flower-heads very few fertile seeds. If the farmer would only recognise this, and remove his stock during spring and summer from the paddocks in which kangaroo grass has a hold, a valuable fodder grass would be conserved; otherwise, there is a serious danger of its being eaten out. The proof of this assertion can be seen by any interested person, who will observe the rich growth of kangaroo grass within many railway enclosures, while without not a blade is to be seen. One would infer from its height (it sometimes grows tall enough to hide sheep), and consequent coarseness, that it would not be favoured by stock, but they are extremely partial to it. *Andropogon pertusus*, "Pitted Beard

Wallaby Grass, *Danthonia penicillata*, F. v. M.

A, Spikelet. B, Closed floret showing the three semi-annular rings of hair on the back of glume. C, Open floret. D, Grain, back and front views. (All variously magnified.)

(Reproduced from "Australian Grasses," by F. Turner.)

Grass," usually attains a height of 2 to 3 feet, and prefers a heavy, stiff soil. It is excellent pasturage for the summer season, yielding a large quantity of forage, and it stands constant grazing better than most grasses with which I am familiar. *A. refractus*, "Turpentine Grass," is found attaining a height of from 2 to 3 feet. It is fragrant, and may probably equal in commercial value *A. Schœnanthus*, "Lemon Grass," from which the medicinal Sirri-oil is obtained and exported from India. *A. annulatus*, "Ringed Beard Grass," is a handsome grass, valuable for pastures and suitable for making hay. *A. sericeus*, "Silky Blue Grass," is a good perennial pasture grass from 1 to 2 feet high, and grows profusely during the summer months. *A. affinis*, "Brown Beard Grass," is a good open pasture grass, yielding a fair amount of forage, and capable of standing close feeding by stock. *A. bombycinus*, "Woolly Beard Grass," an erect perennial grass, is highly spoken of by pastoralists as a fattening grass for stock. *Eleusine cruciata*, "Finger Grass," is a valuable fodder grass, requiring a rich soil and, like other summer grasses, it grows spontaneously after a year's cultivation.

The handsome *Pollinia fulva*, "Browntop," with its long, tawny spikes, deserves more than a passing notice. It is closely allied to the *Andropogons*, some species of which it very much resembles. It is an excellent pasture grass, and during the summer months, it produces a great amount of herbage. *Pappophorum nigricans*, "Nigger Head," is perennial, but affords only a small quantity of forage. *Imperata arundinacea*, "Blady Grass," with its long white silky spikes, is very conspicuous, and in its young state is relished by stock. It makes excellent thatch, and is used by brickmakers in preference to any other grass for protecting their bricks while wet. *Eragrostis Brownii*, "Common Love Grass," a valuable grass readily eaten by stock, is perennial, and on alluvial soils will yield a large amount of rich herbage. Another of the perennial species is *Amphipogon strictus*, "Bearded Heads," which is drought-resisting, and yields a fair amount of fodder. Of the *Panicums*, *P. Crus Galli*, "Barnyard Grass," is an annual species attaining a height of 4 to 5 feet, and most suitable for moist situations. It is valuable for cutting as green feed. *P. sanguinale*, "Summer Grass," is an annual of good value as fodder, but the seed must be sown thickly to avoid rankness. It has been known to yield from 1½ to 2 tons per acre. *P. decompositum*, "Umbrella Grass," is valuable both for pasture and fodder, and will succeed in any ordinary soil. *P. divaricatissimum*, "Spider Grass," which attains a height of from 1 to 2 feet, is drought-resisting and nutritious, and is one of our most valuable perennial grasses for laying down as permanent pasture. *P. gracile* is a perennial species which makes excellent hay, and thrives in ordinary soil. *Hemarthria compressa*, "Mat Grass," a creeping perennial species, straggling to a length of from 3 or 4 feet, and rooting at the joints, affords a coarse fodder around swamps and the margins of rivers, and is therefore useful in lands where these physical conditions obtain. *Poa cæspitosa*, "Tufted Meadow Grass," is abundant in some localities, and when young makes excellent forage; when it is dry, stock avoid it if other herbage is obtainable. *Agropyrum scabrum*, "Common Wheat Grass," is plentiful in most places, and one of the earliest native grasses of the spring. *Deyeuxia Forsteri*, "Toothed Bent Grass," is an annual, found in many places, and in early spring it is rich and succulent, and

Kangaroo Grass, ***Anthistiria imberbis***, Retz.

A, Compound cluster of spikelets. B, A cluster of male or barren spikelets and the fertile one, opened out to show how they are arranged. C. The fertile spikelet opened out to show the three glumes and awn. D, Grain, back and front views. (All variously magnified.)

(Reproduced from "Australian Grasses," by F. Turner.)

consequently of value. *Chloris truncata,"* "Windmill Grass," is a good grass for stock, and resists drought conditions fairly well. *Setaria glauca,* "Pigeon Grass," is an annual species, widely distributed over the State, which produces excellent pasturage on good soils during the summer months, and stock of all kinds are remarkably fond of it. *Microlæna stipoides,* "Weeping Grass," is a perennial species, with stems from 1 to 2 feet in height. It is a superior pasture grass for moist situations, and is readily eaten by stock. Baron von Mueller and L. Rummel give the following chemical analysis, made on the spring growth of this grass:—Albumen, 1.66; gluten, 9.13; starch, 1.64; gum, 3.25; sugar, 5.05 per cent.

Festuca littoralis, "Coast Fescue," is a strong perennial grass, and splendid for binding drift sand near the coast. *F. duriuscula,* "Hard Fescue," is a perennial species of 1 to 2 feet high, which is found in the mountainous parts of this State. It thrives well in hilly places, and is a useful pasture grass, especially for sheep. According to Bentham, it is one of the widely-dispersed forms of the "Sheep's Fescue," or *F. ovina,* (Linn.), very abundant in downs and hilly pastures of the temperate regions, both of the new and old world.

Analysis of Festuca duriuscula.

Mr. Martin J. Sutton gives the following analysis of this grass:—

	Grass in Natural State.	Dried at 212 Fahr.
Water	61·98	..
*Soluble albuminoids	0·17	0·44
†Insoluble albuminoids	1·50	3·94
Digestible fibre	6·53	17·18
Woody fibre	23·19	60·99
‡Soluble mineral matter	1·52	4·01
§Insoluble mineral matter	0·86	2·26
Chlorophyll, soluble carbo-hydrates, &c.	4·25	11·18
	100·00	100·00
*Containing nitrogen	0·03	0·07
†Containing nitrogen	0·24	0·63
Albuminoid nitrogen	0·27	0·70
Non-albuminoid nitrogen	0·11	0·29
Total nitrogen	0·38	0·99
‡Containing silica	0·38	0·99
§Containing silica	0·47	1·34

Dichelachne crinita, "Long-hair Plume Grass," is conspicuous when in inflorescence. On good soils it does well, producing succulent herbage, and is relished by stock generally. *Glyceria fluitans,* "Manna Grass," is valuable on account of supplying good herbage in damp localities, where other good grasses are scarce.

Besides those mentioned there are other native grasses, which are of value, as well as a number of indigenous herbs, which are eaten by stock. Probably the most useful of the herbs are *Trigonella suavissima,* "Sweet

Fenugreek"; *Erodium cygnorum,* "Blue Erodium"; *Geranium dissectum,* "Cut-leaved Geranium"; *Lavatera plebeja,* "Austral Hollyhock"; *Daucus brachiatus,* "Austral Carrot"; *Plantago varia,* "Variable Plantain" and *Lotus corniculatus,* "Birdsfoot Trefoil."

Exotic Forage Plants.

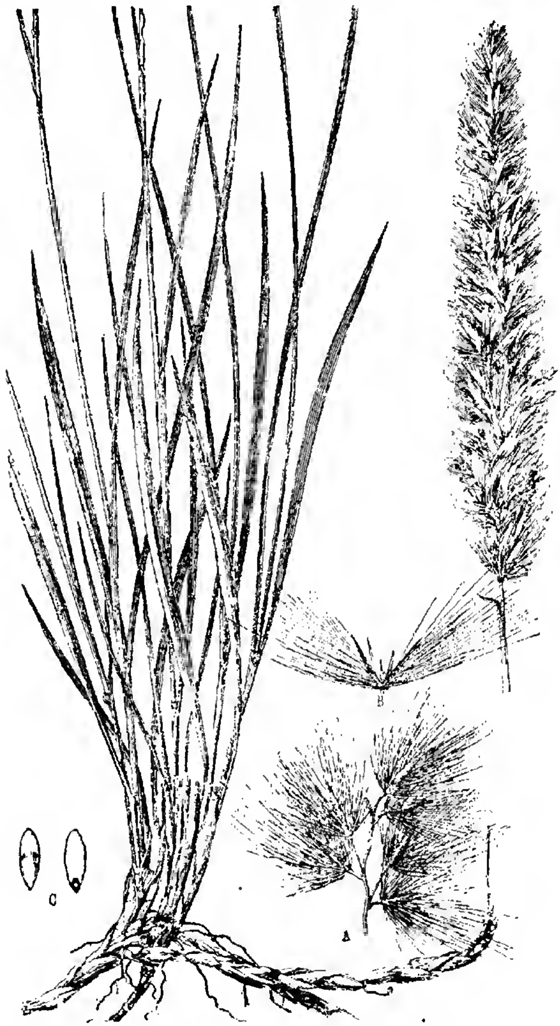
(*Non-Grasses.*)

Among the exotic forage plants which have become acclimatized *Trifolium repens,* or "White Clover," forms a considerable portion, and in spring many pastures are white with its flowers. *T. hybridum,* "Alsike Clover", *T. pratense,* "Red Clover"; *T. fragiferum,* "Perennial Strawberry Clover"; are extensively grown in some localities, and during the spring months make good stock forage. *T. resupinatum,* "Annual Strawberry Clover"; *T. subterraneum,* "Subterranean Clover"; *T. tomentosum,* "Woolly-headed Clover"; *T. glomeratum,* "Clustered Clover"; *T. incarnatum,* "Carnation Clover"; *T. minus,* "Slender Clover"; *T. parviflorum,* "Small-flowered Clover"; *T. procumbens,* "Yellow or Annual Hop Clover"; *T. striatum,* "Knotted Clover"; *Medicago sativa,* "Lucerne"; *M. tribuloides,* "Caltrop Medick"; *M. maculata,* "Spotted Medick"; *M. denticulata,* "Burr Medick"; *M. orbicularis,* "Flat Snail Clover"; *M. scutellata,* "Snail Clover"; *M. lupulina,* "Black Medick"; *Melilotus alba,* "Bokhara Clover"; *M. parviflora,* "Small-flowered Melilot"; *Poterium sanguisorba,* "Salad Burnet"; *Plantago lanceolata,* "Ribwort Plantain"; *Vicia sativa,* "Vetch or Tare"; *Anthyllis vulneraria,* "Kidney Vetch"; *Onobrychis sativa,* "Sanfoin"; *Trigonella ornithopioides,* "Winged Pea," and several other useful forage plants are now established in pastures.

Exotic Grasses.

About 95 exotic grasses have become naturalized in many parts of Victoria, and several have been extensively cultivated. Among the better known is *Dactylis glomerata,* "Cocksfoot Grass." It is a perennial species, growing to a height of two or three feet, which flourishes on moist, rich soil, and provides appetising herbage for all classes of stock during the winter and spring months. It is not a suitable grass to sow with others, as, owing to its rankness, it crowds out the smaller kinds. To be used to most advantage, it should not be allowed to attain maturity, as it then becomes a coarse tuft, and is avoided by stock when other grasses are obtainable. Baron von Mueller and L. Rummel give the following chemical analysis made on the late spring growth of this grass, viz.: Albumen, 1.87; gluten, 7.11; starch, 1.05; gum, 4.47; sugar, 3.19 per cent.

Lolium perenne, "Perennial Rye Grass," is one of the best known of all the utilitarian grasses. In the colder districts this grass is a valuable addition to the pastures, yielding a quantity of good herbage, of which dairy cattle are particularly fond. A moist, rich, alluvial soil is most suitable to its growth, and it makes capital hay. It produces abundant seed, ripening about November.



Blady Grass, *Imperata arundinacea*, Cyr.

A, Showing the arrangement of the spikelets on the rhachis. B, A spikelet opened out showing the four glumes and palea. C, Grain, back and front view. (All variously magnified.)

(Reproduced from "Australian Grasses," by F. Turner.)

ANALYSIS OF LOLIUM PERENNE.

Mr. Martin J. Sutton gives the following analysis of this grass:—

	Grass in Natural State.	Dried at 212 Fahr.
Water	62·01	..
*Soluble albuminoids	0·38	1·00
†Insoulble albuminoids	2·06	5·38
Digestive fibre	7·98	21·01
Woody fibre	17·71	46·62
‡Soluble mineral matter	2·90	7·64
§Insoluble mineral matter	0·78	2·05
Chlorophyll, soluble, carbo-hydrates, &c.	6·18	16·30
	100·00	100·00
*Containing nitrogen	0·06	0·16
†Containing nitrogen	0·33	0·86
Albuminoid nitrogen	0·39	1·02
Non-albuminoid nitrogen	0·38	1·00
Total nitrogen	0·77	2·02
‡Containing silica	0·05	0·13
§Containing silica	0·32	0·84

Poa pratensis, "English Meadow Grass"; or "Kentucky Blue Grass," is a perennial species, with creeping rootstock, very suitable for light, dry soils, and adapted for sowing with other pasture grasses. It stands drought well, and is frequently used for lawns and binding embankments, being easily propagated by division of its roots. Its foliage is tender and nutritious, and suitable for stock generally.

Bromus unioloides, "Prairie Grass", is a valuable winter grass, growing continuously, and spreading rapidly from seed, particularly on rich and somewhat humid soils. It has proved to be one of our best acquisitions as a lasting and nutritious fodder grass. Baron von Mueller gives the following chemical analysis of the spring growth of this grass, viz.:—Albumen, 2.80; gluten, 3.80; starch, 3.30; gum, 1.70; sugar, 2.30 per cent.

Sorghum halepense, "Johnson Grass," or "Haleppo Grass," is a perennial grass, suitable for permanent pasture in land of alluvial nature, where it frequently attains a varying height of 5 to 7 feet. Two or 3 tons of hay crop may be cut from an acre during the season. Stock of all kinds relish it, and it keeps green in the heat of summer. Owing to the matting nature of its root-stocks it should be kept from cultivated land. *Phleum pratense,* "Timothy Grass," is a very valuable and much-cultivated perennial fodder grass, and particularly useful for mixture with other grasses for permanent pasturage. The best advantage is derived from this grass when it is sown with clovers, and it is well adapted for irrigated land, where the yield of hay is usually from 2 to 5 tons per acre. It is, however, a hardy grass, and thrives on almost any soil, and is much favoured by pastoralists.

Festuca elatior, "Meadow Fescue," is a perennial grass, reaching a height of several feet, and produces excellent nutritious hay. There are several varieties of this species, the tallest (*arundinacea*) being very suitable for irrigated land, preferentially among the best of fodder

grasses, but is not suitable for dry, poor soils. *Alopecurus pratensis*, "Meadow Fox-tail Grass," is one of the best of perennial pasture grasses, on which sheep thrive well and when combined with white clover will carry about four or five sheep to the acre. For best results it requires land not too dry. In permanent artificial pastures this grass should form one of the principal ingredients on account of its lasting and nutritive nature. Its yield of hay on good soils is usually 2 to 3 tons per acre. *Cynosurus cristatus*, "Crested Dog's-tail Grass," of perennial nature, drought-resisting, with root penetrating to a considerable depth, is suitable for permanent pasture, and it forms thick tufts without crowding out other grasses. It is generally regarded as suitable for the hilly country of Gippsland, where it has proved its value in increasing the carrying capacity of land by at least a sheep per acre above land sown with other grasses. *Anthoxanthum ordoratum* "Scented Vernal Grass," is a perennial species, growing from 12 to 18 inches in height, and has become fairly established in pastures, where its presence can be readily detected by its pleasant odour. This is due to a fragrant principle called cumarin. Scented Vernal Grass is occasionally used for mixing among permanent grasses in pastures, where it will continue long in season.

Trisetum pratense, "Yellow Oat Grass," is a useful perennial meadow grass, with golden yellow inflorescence. It thrives well when mixed with other grasses, and will grow in marl and calcareous soil, as well as in all light land rich in humus, particularly in that which contains lime, and where the last-named condition obtains it forms a most suitable under-grass. The forage is of good quality, and is eagerly sought by cattle. *Paspalum dilatatum*, "Golden Crown Grass," is valuable as a hay and pasture grass, and has been greatly praised by agriculturists. It is said to remain green when all other grasses are dried up, has given fair results under irrigation, and has been known to support one dairy cow to the acre the year round. While it grows well on nearly all types of soil, it gives the best return on rich black soils.

Ammophila arundinacea, "Marram Grass" (introduced from Europe to this State by the late Baron von Mueller in 1853) is one of the most important of reedy grasses for reclaiming or fixing drift sand on the seashore, for the consolidation of which this tall grass and *Elymus arenarius*, "Sand Lyme Grass," are chiefly employed. Its habit of growth is similar to that of Mat or Couch Grasses. The young plant extends a long creeping root, from which at intervals of from 3 to 5 inches a tuft arises and forms a tussock. From this tussock smaller roots penetrate, and when drift sands rise the tuft forms roots higher and higher, thus preventing the complete destruction of the plant, and forming a rise of fixed sand. When growing vigorously these tussocks combine, thus making a dense mass difficult to walk through. The method of planting sections of roots for new growth, is usually in rows 6 feet apart, the pace between each plant being about 2 feet. Like *Elymus arenarius*, it possesses no feeding value, and is rejected by all herbivorous animals. It is, however, an excellent material for thatch. *Milium effusum*, "English Meadow Grass," is a good perennial grass, and much relished by stock. It sometimes attains a height of 6 feet, and is well suited for damp forest land, the pastoral capabilities of which it enhances. On river-banks nutritious hay to the extent of 3 tons to the acre has been obtained from this grass. *Agrostis alba*,

"White Bent Grass," or "Fiorin Grass, is a perennial grass, showing a predilection for moisture. It is valuable as an admixture to many other grasses, as it becomes available at the season when some of them fail.

Hints on Sowing Grass Lands.

By means of artificial sowing, not only double, but in some cases four times the amount of food may be obtained from a given area of land than it would produce under natural grasses. The method of preparing the land for sowing grass varies according to the soil, climate, and condition. New or cultivated land should be turned up by ploughing the previous season, and on the approach of seed-time, broken up with cultivator, rolled and harrowed. It is preferable to sow seed in autumn, after the land has had sufficient moisture from rains. A light grass-seed harrow should be used for covering the seed, and the ground then rolled. The land should be well covered with seed—about 40 lbs. to the acre on ordinary soils. The proportion of the different kinds of seeds to use will, of course, depend on the nature of the soil and the kind of stock it is intended to graze. To ensure good permanent pasture lands, it is advisable that they should not be grazed too bare in the summer. Good management is necessary, and stock should be put in paddocks alternately, so that each area may have time to recuperate.

In soils that are not very rich, a dressing with manure is advisable. A very satisfactory fertilizer consists of 1 cwt. of superphosphate, ½ cwt. sulphate of ammonia, and ½ cwt. of sulphate of potash, which impart phosphoric acid, nitrogen, and potash respectively. Pastures treated with these ingredients will hold for fully five years, and probably be in better condition at the end of that time than before treatment. Clovers of all kinds are greatly benefited by a dressing of lime—a fair quantity being about half a ton to the acre—and the early spring is a good time to apply it. The lime should be air-slacked by exposing it in small heaps to the weather, and then spread evenly over the surface.

Selection of Grasses.

Before concluding this brief review of some of our best known grasses it should be mentioned that the proper kinds for pastures must depend on several circumstances, such as soil, drainage, habit of growth, productions, &c. No one kind of grass can be expected to be adaptable to all conditions, neither can any given mixture of grasses. For example, one man finds a certain grass to be very productive on his farm, and he thinks he has found the great desideratum, and at once praises it, and recommends its use, without regard to the conditions which may be absolutely necessary to its success. Another man purchases the new seed, perhaps at an exorbitant price, and without a knowledge of its peculiar habits, gives it a trial, and finds it a failure, probably on account of climate, soil, or other conditions being unsuitable for its wants.

Mr. Sutton, writing on this subject, says:—"The whole question is one of experience, and I am well persuaded that those who possess the largest knowledge drawn from the widest sources, will concur in the opinion that each individual case should be considered independently, and upon its own merits. I would lay great stress on the necessity of a clear understanding of the conditions, and capability of the soil. The

subsoil, too, must be taken into account, for sooner or later its influence will tell decisively upon the existence of certain grasses.

Then the purpose of the grass crop must not be overlooked. Whether it is chiefly for hay, or entirely for grazing, will prove an important consideration in determining the sorts to be sown. Even the kind of cattle the land is intended to carry is worth more than a passing thought. Milch cows, fattening stock, sheep and horses, or a combination of these can be provided for if a definite object is held steadily in view."

In old and well-settled districts there is much accumulated experience among farmers, of which a beginner desiring to avoid mistakes should avail himself. Still, an observing and progressive man will sometimes depart from established rules and practices in the introduction of new kinds of cultivation, and it is only thus that progress and improvement can be made. In this respect only some attempts have been made at the cultivation of our grasses, and these trials have not been sufficiently exhaustive to give absolute proof of their value for general systematic cultivation, and we are still very much in the dark as to their worth.

It is advisable that cattle and sheep be not put upon grass too early in the spring, before it has fairly commenced to grow. This rule particularly applies to sheep, that will in such cases eat the heart out of the grass crown, to its entire destruction. No precise date can be given for beginning to graze pastures in the spring. Cattle may be turned in when there is enough grass to meet their wants, and when the ground is firm enough to prevent their hoofs damaging the young shoots. Many grasses are prevented from seeding, owing to overstocking of lands, and consequently propagate only from the roots. It is a very important point that all possible endeavours should be made to preserve our native grasses, as they are by nature fitted for the particular region, where they grow, and it is improbable that introduced grasses can take their places satisfactorily. Many of the native grasses are benefited by a judicious application of water. Our rainfall is usually enough in the spring, and if sufficient water could be stored to keep up a strong growth as the dry, hot weather advances, a plentiful supply of summer forage would be assured.

The annual report of the director of the Californian Experimental Station states that, in order to determine whether barley has a tendency to dry up milch cows, as is sometimes claimed, five cows in the University Farm dairy herd have been fed rolled barley as exclusive grain feed for varying periods during the past two years. The production in one cow during the past two lactation periods on barley was considerably increased over that during the first lactation period when mixed grain was fed, while the other cows produced somewhat less milk or butter fat on barley than during corresponding periods when fed mixed grain. The results do not indicate that the feeding of barley tends to dry up milch cows, but they suggest that most cows do not do as well on barley alone as on mixed rations. Three of the cows had heavier average body weights when on barley than when fed mixed grain, while the opposite was true in the case of one cow.—*Farmers' Union Advocate*, N.Z., November, 1917.

FRUIT PROSPECTS, 1917-18.

By P. J. Carmody, Chief Orchard Supervisor.

A perusal of the District Supervisors' reports on the present season's prospects of the fruit crop will show that, unfortunately, growers are not going to realize the abundant fruit harvest that they some time ago anticipated.

The comparative failure in all fruits except apples is due to the abnormally wet winter that was experienced and the unfavorable weather conditions at the time of setting. Many trees in the different fruit centres have perished in consequence of excessive wet, and, instead of growers extending their areas as they have done, better results would have been obtained if some of the cost of extension had been devoted to the drainage of those parts already planted.

Trees debilitated by adverse soil conditions cannot be expected to set even normal crops of fruit; so that under present circumstances, unless provision is made for the efficient drainage of the orchard, similar disappointments in future will be experienced.

At the time of blooming during the past two seasons there was but little sunshine, and consequently a lack of bee activity in the orchard, whereby the intercarriage of pollen between different varieties, so essential to the successful setting of the fruit, was at a minimum. It would be, in my opinion, a great advantage for growers to have a few hives of bees dispersed throughout their orchards, so as to give the fullest opportunity during periods of intermittent sunshine for the bees to exercise their influence in the setting of the crop.

Subjoined are the reports of the District Supervisors:—

Doncaster District—A. A. Hammond, Orchard Supervisor—

Apples.—Medium to good. The Rome Beauty and London's have not yet set, but promise a good crop. Yates are light. Jonathans, the leading variety and most largely grown, have set a fair crop.

Apricots.—Medium. Very little grown.

Pears.—Very light. The pear crop is almost a complete failure. The setting of all varieties was more or less affected by Black Spot. The Beurre Bose suffered most. Judging from present appearances, there will not be more than 10 per cent. of a normal crop harvested.

Peaches.—Medium. Early varieties are light. The Leaf Curl fungus was bad this season. A large number of trees were killed owing to the defective drainage, consequently the crop will fall below the average by 15 to 20 per cent.

Plums.—All varieties are light, and fall far short of an average crop.

Cherries.—Very light. The cherry crop is very patchy. A few orchards have a good crop, but, on the whole, there does not appear to be 50 per cent. of a normal crop.

Lemons.—Good. The lemon plantations look well, despite the wet winter.

Strawberries.—Good.

The most serious failure in Doncaster district is in the pears, which are the chief product of a majority of the larger orchards.

Evelyn and Central Districts—J. Farrell, Orchard Supervisor—

Apples.—Jonathan, in some localities, light, but, on the whole, a fair crop. Late blooming varieties—Five Crown, Rome Beauty, &c.—are setting well. Others, mostly heavy.

Pears.—Williams Bon Chretien, light to medium; Howell, Beurre de Capiaumont, Vicar of Winkfield, medium; others, medium to light.

Plums.—Most of the varieties set well, but have thinned out to a medium crop

Cherries.—Early varieties, light; late sorts, a good crop.

Evelyn and Central Districts—*continued.*

Apricots.—Oullin's Early and Moore Park, medium to heavy; others, medium.

Peaches.—In most localities early sorts a medium crop; late sorts are better.

Quinces.—All varieties, light to medium.

Figs.—First crop, medium.

Passion Fruit.—Owing to the continual heavy rains, the vines look rather unhealthy, and the crop will probably be light to medium.

Loquats.—Light.

Lemons.—Medium.

Oranges.—A fair crop.

Gooseberries.—Light to medium. Roaring Lion is best.

Currants.—White, light to medium. Black, medium to heavy.

Raspberries.—Having made a strong growth last year, the canes are looking well, and, thrip not being present, a good crop may be expected.

Loganberries.—Same as raspberries.

Blackberries.—These are looking exceptionally well, and should bear a heavy crop.

Strawberries.—This year again the weather has been rather wet and cold for these, but, on the whole, the plants look well, and should yield a good crop.

Diamond Creek District—E. Wallis, Orchard Supervisor—

Owing to the unfavorable weather conditions obtaining when trees were in bloom, and also to a severe frost experienced on the 8th of October, the stone fruits and pears have not set well. The effect of the frost referred to was quite unusual, as the young fruit (peaches especially) remained on trees for as long as ten days after being affected before dropping.

Apples.—Heavy. Jonathan has set rather unevenly, but, on the whole, there promises to be a medium to heavy crop of this favorite variety. Some varieties, such as Rymer, have set an exceptionally even and heavy crop.

Apricots.—Light (not extensively grown).

Cherries.—Light.

Peaches.—Light.

Pears.—Light to medium.

Plums.—Light.

Quinces.—Light to medium.

Northern District—S. A. Cock, Orchard Supervisor—

Owing to the abnormally wet season experienced, the fruit crop of the Northern District promises to be extremely light. Leaf Curl has been very prevalent on the peaches, and Black Spot is everywhere prevalent right through the apple centres, and spraying with fungicides is still being continued to check its ravages. Taking the various centres of the district—Swan Hill, Echuca, Bendigo, and Castlemaine—the following will show the present position of the crop:—

Apples.—Light to medium.

Apricots.—Light.

Almonds.—Medium.

Cherries.—Medium.

Citrus Fruits.—Promise heavy crop.

Figs.—Medium.

Grapes.—Promise heavy crop.

Pears.—Light.

Plums.—Light.

Peaches.—Light.

Quinces.—Medium.

Tomatoes.—Medium.

Mildura District—G. H. B. Davidson, Orchard Supervisor—

Citrus.—Blossomed well, and promise a heavy crop, but too early to say, as they are not yet over the dropping stage.

Apricots.—Carrying heavy crops, both at Mildura and Merbein.

Peaches.—Showing good crops.

Pears.—Good, heavy in some orchards and light in others.

Plums.—Good. Prunes carrying good crops.

Figs.—First crop light.

Almonds.—Good.

Goulburn Valley District—G. M. Fletcher, Orchard Supervisor—

Shepparton.

Peaches.—Early desert—Briggs', Hale's—light. High's Early show best promise, but they are only medium. Elberta's, very poor. Mid-season varieties, light. Pullar's, poor. Other clings, poor.

Pears.—Williams', light to fair.

Nectarines.—Fair.

Apricots.—Light to very poor. Oullin's show best crop.

Grapes.—Medium to very poor.

Ardmona.

Desert Peaches.—All poor, except High's and Late Red, which are fair to good. Elberta's, poor to medium. Mid-season, light. Pullar's and other clings, light to very poor.

Nectarines.—Medium to light.

Plums and *Prunes.*—Medium.

Cherries (small area).—Fair.

Pears.—Present showing, fair to good, but dropping badly yet, and affected with Black Spot.

Apples.—Fair, but affected with Black Spot.

Apricots.—Young trees fair, but old trees very poor to poor. Fruit still dropping, and trees suffered badly from excessive wet weather.

Plums and *Prunes.*—Medium.

Vines.—Poor. Black Spot prevalent.

Tatura, Merrigum, Kyabram.

Prospects similar to Ardmona. Citrus blossom all through the district is particularly good.

Summary.—On the whole, the crop will be below average. Individual orchards having good natural drainage show good crops; but those on heavy ground, or subject to lodgment of water, suffered badly. Ardmona growers consider this the worst season of their experience. Black Spot and Leaf Curl have contributed very largely to the lightness of the crop in those varieties subject to those diseases. As both apricots and pears are still dropping badly, it is difficult to determine an estimate. Shapparton settlements suffered very badly through loss of trees—peaches and apricots. The heaviest losses have been in Pullar's cling. Where spraying was possible, the crop shows a marked improvement over the unsprayed trees. Many acres were unsprayed for fungus, as it was not possible to put a pump on the ground all winter.

South-Eastern District—E. Meeking, Orchard Supervisor—

Apples.—With the exception of Yates', in which the setting is patchy, all varieties give promise of an abundant yield.

Pears.—All varieties are very light.

Apricots.—Generally light. In a few places, medium.

Cherries.—Confined principally to the Red Hill district, where all varieties except St. Margaret are medium to heavy. The latter variety is light.

Plums.—Ordinary varieties, generally light. A few Japanese, medium to heavy.

Strawberries.—Throughout the Red Hill district there is a full average crop.

Horsham, Dimboola, Daylesford, Dunolly, Stawell, &c., Districts—Wm. Pitt Chalmers, Orchard Supervisor—

Horsham and Dimboola.

Apples.—Heavy.

Pears.—Light.

Peaches.—Very light.

Apricots.—Light to medium.

Plums.—Good.

Quinces.—Light.

Almonds.—Good.

Figs.—Fair.

Daylesford, Clunes, and Talbot.

Apples.—Good.
Pears.—Light.
Plums.—Fair.
Cherries.—Good.
Berry-fruits.—Heavy.

Amphitheatre, Elmhurst, and Eversley.

Apples.—Good.
Pears.—Very light.

Dunolly, Bet Bet, and St. Arnaud.

Apples.—Heavy.
Pears.—Light.
Grapes.—Good.
Plums.—Medium.
Apricots.—Medium.
Cherries.—Medium.
Peaches.—Light.
Almonds.—Light.

Stawell and Pomonal.

Apples.—Heavy.
Pears.—Light.
Cherries.—Fair.
Plums and Apricots.—Light.

Guildford, Newstead, and Muckleford.

Apples.—Medium.
Pears.—Failure.
Plums.—Light.

Geelong, Colac, Portland, Forrest, and Casterton Districts—A. G. McCalman, Orchard Supervisor—

Apricots.—In most orchards there have set heavy crops, in many cases too heavy for a good sample. On the whole, the crop will be heavy. The principal varieties are Moor Park, Mansfield Seedling, Hemskirke, and Turkey. In one or two cases loss was caused by frost.

Apples.—Practically all varieties have set heavy crops. Jonathan, Reinette de Canada, Cleopatra, Rokewood, Dunn's Favorite, Delicious, Æsopus Spitzenburg promise heavy yields. Rome Beauty and London Pippin promise well, but it is too early to be sure.

Pears.—Pears are light crop nearly everywhere. Gansell's Bergamot, Williams', and Black Achan are fair in a few orchards.

Plums.—The crop will be fair. Cherry plums are light. Black Diamond, Angelina Burdett, Early Orleans are mostly a good crop.

Cherries.—The crop will be good. Florence, Bedford's Prolific, Biggereau Twyford, are generally heavy. St. Margarets are mostly light.

Peaches.—These will be light for early varieties, which are mostly grown. Late varieties are fair.

Colac and Warncoort.

At Warncoort all varieties of *Apples* promise heavy yields. About Yeo and Irrewillipe apples will be good.

Pears.—Keiffer's Hybrid will be fair; Williams', light.

Apricots.—At Warncoort, are light and marred by scab, owing to the exceptionally wet spring.

Portland District.

Apples.—Jonathans, vary from heavy to medium. Munro, Adam's Pearmain, Cleopatra are a good crop. Rokewood and Ben Davis are heavy, and Sturmer and Hoover are fair. Jonathan is the principal variety grown.

Pears are light.

Forrest District.

Apples are a fair crop. Rokewood, Statesman, Emperor Alexander are fair, and Rome Beauty and London Pippin show abundant bloom.

Pears are very light.

Casterton.

Apples are about half a crop.

Pears a failure.

Peaches and *Apricots* are poor.

The season here has been the wettest on record, and some of the trees have been killed by excess of moisture.

Summary.—Apricots will be heavy, and, except in low situations, fairly free from scab. Apples will be heavy, except where excessive rain has interfered. Pears will be light, and mostly affected with Black Spot. Plums will be a medium crop. Cherries will be a good crop. Peaches will be light. Gooseberries are a fairly good crop.

Gippsland District—L. Pilloud, Orchard Supervisor—

The conditions during the season have been unfavorable, principally owing to excessive rain and heavy frosts. Frosts occurring as late as 9th, 10th, and 11th October did much damage. The season has been the wettest known in Gippsland for years past, and during October there were only five fine days. The apple crop throughout Gippsland ranges from medium to heavy. Yates' are heavy in some orchards, but very light where the frosts were more severely felt. London's and Rome Beauty are just setting; they are only medium.

Pears are very light, only odd fruits being noticeable.

Peaches.—The early varieties are very light, but canning sorts are good at Drouin, Warragul, Cowwarr, Wy Yung, Bairnsdale, and Bruthen.

Apricots are good at Bairnsdale and Cowwarr; not much of this fruit is grown in other places.

Plums are good at Bairnsdale, Drouin, Warragul, Bunyip, and Garfield.

Quinces are good at Bairnsdale, Pakenham, Bruthen, and Rokeby; not grown in other districts.

Cherries are good at Nar-Nar-Goon, Garfield, Warragul, Cowwarr, and Bairnsdale.

Passion Fruit.—Good at Drouin and Wy Yung; not grown in other parts of my district.

Strawberries.—Good crop at Pakenham, Drouin, Warragul, Buln Buln, and Bairnsdale.

North-Eastern District—C. F. Cole, Orchard Supervisor—

Owing to the abnormally wet spring, apples and pears have set a light crop generally, although the blossoming was heavy.

Peaches.—Medium to light.

Plums.—Medium to light.

Prunes.—Heavy, medium to light.

Apricots.—Heavy to medium.

Cherries.—Heavy to medium.

Almonds.—Light.

Figs.—First crop, medium to light; second crop, promises to be heavy.

Quinces.—Light.

Oranges and *Lemons* promise well.

Small Fruits—Raspberries, Gooseberries, &c.—heavy.

Walnuts.—Light.

Loquats.—Light.

Japanese Plums.—Heavy to medium.

STANDARD TEST COWS.

REPORT FOR QUARTER ENDED 30TH SEPTEMBER, 1917.

The cows completing the term number 88, of which 82 attain the standard. The following new entries have been received since the last report:—Mr. O. J. Syme, Macedon (Holstein-Friesian); Mr. A. H. S. Schier, Caldermeade (Ayrshire); Mr. V. Brumley, Ruby (Ayrshire); Messrs. Leach Bros. Binginwarri (Jersey); Mrs. A. Gibbs, Bunawn (Jersey); Mrs. L. Orchard, Graham Vale (Jersey); Mr. F. Bidgood, Stughorn (Jersey); Messrs. Meier Bros., Box Hill (Jersey); Mr. W. K. Atkinson, Swan Hill (Milking Shorthorn).

Individual returns are as follow:—

DEPARTMENT OF AGRICULTURE, Werribee. (Red Polls.)

Completed since last report, 24. Certificated, 19.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Asiana¶	Not yet allotted	24.6.16	1.7.16	273	13½	6,405	4·67	302·28	250	344½
Violet III. ..	"	30.9.16	7.10.16	273	8	5,786	4·60	266·03	250	303½
Brittania.. ..	"	1.10.16	8.10.16	*251	15	7,845	3·90	306·12	250	349
Persica	"	1.10.16	8.10.16	273	18	†6,014	5·02	301·76	250	344
Serbia	"	6.10.16	13.10.16	273	19	8,841	4·32	382·03	250	435½
Mongolia ..	"	11.10.16	18.10.16	273	12½	7,704	4·18	322·15	250	367¼
Netherland ..	"	11.10.16	18.10.16	273	26	10,373	3·89	403·69	250	460¼
Russia	"	17.10.16	21.10.16	273	10	6,580	4·00	263·47	200	300¼
Bullion	"	19.10.16	30.10.16‡	215	4	7,892	4·22	333·30	250	380
Malaysia ..	"	14.11.16	21.11.16	273	12	6,182	4·54	280·83	250	320¼
Coinage	"	12.12.16	19.12.16	273	24½	7,125	4·02	286·57	175	326¾
Lallah	"	6.12.16	20.12.16‖	273	23	6,809	4·56	310·72	175	354¼
Tabeltina ..	"	13.12.16	20.12.16	273	20½	6,822	3·99	272·37	175	310½
Sylph	"	14.12.16	21.12.16	273	18½	6,681	4·53	302·69	175	345
Santa Clara ..	"	15.12.16	22.12.16	273	30	8,488	4·53	384·61	200	438½
Azora	"	16.12.16	23.12.16	273	18	6,298	4·06	255·71	175	291½
Pacifica	"	18.12.16	25.12.16	273	8	6,253	4·46	279·06	250	318
Gallipoli	"	20.12.16	27.12.16	273	15½	7,262	4·11	298·74	250	340½
Birdseye	"	23.12.16	30.12.16	273	18	7,596	5·16	392·07	250	447
Argentina ..	"	25.12.16	1.1.17	*263	19	7,716	3·75	289·55	250	330

* Sold before term expired.
† Sickness for 11 days affected yield.
‡ Date of entry extended 4 days, owing to an attack of milk fever.
‖ Date of entry extended 7 days, owing to effects of premature calving.
¶ By an oversight this record was omitted from last Annual Report.

GEELONG HARBOUR TRUST, Marshalltown. (Ayrshire.)

Completed since last report, 8. Certificated, 4.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Princess Edith of Gowrie Park	2876	25.9.16	2.10.16	273	11½	6,060	4·26	258·43	250	294½
Bluebell of Sparrovale	Not yet allotted	25.9.16	2.10.16	273	10½	4,353	4·32	175·51	175	200
Flower of Sparrovale	"	18.10.16	25.10.16	273	12¼	4,581	4·44	203·22	175	231¾
Madge of Sparrovale	"	12.12.16	19.12.16	273	16	5,313	3·88	207·48	175	236¼

W. C. GREAVES, Monomeith. (Ayrshire.)

Completed since last report, 3. Certificated, 3.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Grace Darling of Warrook	2909	5.10.16	12.10.16	259	4	7,306	4·40	321·63	250	366¾
Vanity of Warrook	2546	6.10.16	13.10.16	273	12	8,241	4·64	382·26	250	435¾
Bit of Fashion ..	1852	23.12.16	30.12.16	273	16	6,447	5·00	322·58	250	367¾

E. HAYES, Archie's Creek. (Jersey.)

Completed since last report, 1. Certificated, 0.

A. JACKSON, Glen Forbes. (Jersey and Ayrshire.)

Completed since last report, 3. Certificated, 3.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Graceful Duchess XI.	394 C.S.J.H.B.	21.9.16	14.10.16*	273	14	5,751	6·43	369·58	250	421¼
Mystery XIV. of Melrose	452 C.S.J.H.B.	21.9.16	14.10.16*	273	15	6,784	5·19	351·94	250	401¼
Princess Mary II. of Strachan (Ayrshire)	Not yet allotted	10.10.16	17.10.16	273	13½	7,153	3·94	282·09	250	321½

* Entry deferred, as first weights not available.

A. W. JONES, "St. Alban's, Geelong. (Jersey.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Silver Queen 2nd of Colac	4032	27.11.16	4.12.16	273	23½	6,318	6·76	427·18	250	487

C. D. LLOYD, Caulfield. (Jersey.)

Completed since last report, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Countess Twylish	928	2.11.16	9.11.16	273	14	7,617	4.54	346·01	250	394½
Spatter	Not yet allotted	24.12.16	31.12.16	*184	8½	2,599	7·30	189·71	175	216½

* Sold before expiration of term.

C. G. KNIGHT, Cobram. (Jersey.)

Completed since last report, 7. Certificated, 7.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Royal Rose ..	2585	28.9.16	5.10.16	273	9	5,952	5·80	345·35	250	393¾
Princess of Tarnpirr	2986	15.10.16	22.10.16	273	9	6,234	4·97	310·08	250	353½
Patchwork ..	Not yet allotted	18.11.16	25.11.16	273	13	4,264	5·64	240·53	175	274¼
Princess May ..	,,	28.11.16	5.12.16	273	19	4,285	5·36	229·62	175	261¾
Idyll's Morocco ..	,,	30.11.16	7.12.16	273	16½	5,147	6·04	310·97	200	354¼
Dolly of Tarnpirr ..	1840	3.12.16	10.12.16	273	24½	5,812	5·17	318·17	250	362¾
Christmas ..	Not yet allotted	17.12.16	24.12.16	273	17½	4,328	6·16	266·63	200	304

C. G. LYON, Heidelberg. (Jersey.)

Completed since last report, 9. Certificated, 9.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Tambourine ..	1417	7.10.16	11.10.16	273	20	7,902	4·98	394·08	250	449¼
Molly II. ..	614	20.10.16	27.10.16	273	12	7,532	4·90	369·05	250	420¾
Pride	Not yet allotted	13.11.16	20.11.16	273	24	7,112	5·21	370·46	250	422¼
Thora II. ..	,,	13.11.16	20.11.16	273	14½	5,086	5·87	298·56	175	340¼
Symphony ..	,,	23.11.16	30.11.16	273	11½	4,760	6·56	312·20	200	356
Thora III. ..	,,	8.12.16	15.12.16	273	20	5,785	6·07	351·06	175	400¼
Magnet's Lass III..	,,	12.12.16	19.12.16	273	15½	5,766	6·05	349·19	175	398
Molly V. ..	,,	13.12.16	20.12.16	273	13½	5,342	5·63	300·95	175	343
Audrey Lassie ..	825	17.12.16	24.12.16	273	19½	7,808	4·55	355·73	250	405½

MUHLEBACH BROS., Batesford. (Ayrshire.)

Completed since last report, 1. Certificated, 1.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Lily of Retreat ..	2961	16.11.16	23.11.16	273	7¼	4,600	4·63	213·18	175	243

G. ROWE, Kardella. (Jersey.)

Completed since last report, 3. Certificated, 3.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Ruby	513 C.S.J.H.B.	9.11.16	16.11.16	273	7	5,798	4·82	279·55	250	318¾
Bluebell of Bright-eyes	562 C.S.J.H.B.	12.11.16	19.11.16	273	4	2,929	6·22	182·21	175	207¾
Princess Dot ..	497 C.S.J.H.B.	19.12.16	26.12.16	273	7½	3,485	5·12	178·40	175	203¼

D. SADLER, Camperdown. (Ayrshire.)

Completed since last report, 2. Certificated, 2.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Lady Clara ..	3094	25.10.16	1.11.16	273	12¼	5,821	4·07	237·26	200	270½
Flirt of Kilmarnock	3091	27.10.16	3.11.16	273	16½	9,312	3·89	362·48	250	413¼

W. WOODMASON, Malvern. (Jersey.)

Completed since last report, 28. Certificated, 28.

Name of Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Standard of Fat required	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.	lbs.
Lady Elector II. of Melrose	Not yet allotted	25.9.16	2.10.16	273	12½	5,524	6·51	359·69	200	410
Empire V. of Melrose	"	28.9.16	5.10 16	273	12½	7,067	5·54	391·68	250	446½
Graceful Duchess XII. of Melrose	"	2.10.16	9.10.16	273	16	5,168	6·19	320·20	175	365
Handsome Girl VII. of Melrose	"	4.10.16	11.10.16	273	13	5,665	7·12	403·18	200	459½
Sweet Pansy II. of Melrose	"	4.10.16	11.10.16	273	6	4,440	5·90	261·94	200	298½
Lassie Fowler V. of Melrose	"	8.10.16	15.10.16	273	14½	5,128	6·03	309·18	200	352½
Gaiety Girl VIII. of Melrose	"	9.10.16	16.10.16	273	18½	6,563	5·99	393·20	200	448¾
Peerless 10th of Melrose	"	11.10.16	18.10.16	273	14½	5,197	6·11	317·37	175	361¾
Peerless IX. of Melrose	"	16.10.16	23.10.16	273	7	4,007	5·60	224·59	200	256
Jessie of Melrose VI.	"	6.11.16	13.11.16	273	24½	7,691	6·74	518·35	250	591
Daisy VI. of Melrose	"	9.11.16	16.11.16	273	9	6,048	5·26	318·15	250	362¾
Zoe V. of Melrose ..	1496	11.11.16	18.11.16	273	11	5,803	6·24	361·94	250	412½
Lady Elector 3rd of Melrose	Not yet allotted	19.11.16	26.11.16	273	9	4,098	6·53	267·59	175	305
Jessie V. of Melrose	3652	20.11.16	27.11.16	273	15	5,279	5·12	321·30	250	366¼
Mystery 15th of Melrose	Not yet allotted	21.11.16	28.11.16	273	9¼	3,740	5·75	215·05	175	245¼
Jessie's Progress ..	3657	22.11 16	29.11.16	273	19	5,916	6·23	368·84	250	420½
Pearl II. of Melrose	3670	22.11.16	29.11.16	273	17½	6,526	5·43	354·71	250	404¼
Graceful Duchess of Melrose VIII.	1056	25.11.16	2.12.16	273	25	7,786	5·70	443·76	250	506
Lily 6th of Melrose..	Not yet allotted	28.11.16	5.12.16	273	15	4,693	6·69	314·10	175	358
Peerless VI. of Melrose	3671	28.11.16	5.12.16	273	10	5,816	5·68	330·22	250	376½
Chevy 8th of Melrose	Not yet allotted	2.12.16	9.12.16	273	23	6,853	6·01	412·06	250	469¾
Pearl 4th of Melrose	"	6.12.16	13.12.16	273	12	4,886	6·06	296·28	175	337¾
Flower VI. of Melrose	3641	7.12.16	14.12.16	273	22½	6,867	5·50	377·94	250	430¾
Quality VI. of Melrose	3674	7.12.16	14.12.16	273	26	8,494	5·31	151·29	250	514½
Chevy VI. of Melrose	3635	7.12.16	14.12.16	273	13½	7.440	4·59	341·27	250	389
Verity VIII. of Melrose	Not yet allotted	9.12.16	16.12.16	273	14	5.999	5·90	353·79	175	403¼
Jessie X. of Melrose	3655	16.12.16	23.12.16	273	11½	5,480	5·61	307·38	250	350½
Mystery XII. of Melrose	3667	17.12.16	24.12.16	273	17½	6,122	5·17	316·61	250	361

EVAPORATION OF APPLES.*

By J. S. Caldwell, Fruit By-Products Specialist, State College of Washington Agricultural Experiment Station.

(Continued from page 684.)

The Carson-Snyder "All-purpose" Evaporator.

In some of the smaller "box" evaporators in household use thirty years ago, the fruit was spread on a series of trays, and a current of warm air was driven horizontally across each tray from one side, escaping at the other, instead of being forced vertically upward through the entire series, as is the case in the tunnel evaporator. This principle was first applied to the construction of a commercial evaporator in a patented machine called the Charlotte evaporator, and was later used in the Carson evaporator. This evaporator consisted essentially of two tunnel-like chambers, one on either side of a central hot-air chamber, which was situated directly over a furnace. Trays were pushed into these chambers along runways, as is the case in the tunnels, but the cleats forming the runways were so arranged that the trays were several inches lower at the side next the central warm-air chamber. Slits in the wall admitted the hot air at the inner side of the trays, it passed horizontally over the trays to the opposite edge, and escaped through a second series of slits into a ventilating shaft. Professor U. P. Hedrick describes and figures such an evaporator in a publication to which reference has already been made, stating that it was, in 1897, the most generally used type of evaporator employed in drying prunes in the State. The reports of the Oregon State Board of Horticulture at about this time contain incidental references to the Carson evaporator as an efficient and satisfactory prune drier, but it seems to have gone out of use, and the writer has not been able to locate a Carson evaporator which is now in operation.

Mr. D. A. Snyder, of the Dayton Evaporating and Packing Company, Dayton, Oregon, is an exceptionally successful evaporator of some 35 years' experience, and operates a large plant, in which he dries not only apples, prunes, and berries, but also a wide variety of vegetables. While some of the basic principles employed in the construction of his drier are identical with those of the Carson evaporator, Mr. Snyder worked them out independently, and, as a result of years of study and experimentation, he has devised so many improvements upon Carson's plan, and has so increased both the efficiency and the economy of operation of his plant, that he deserves chief credit for the development of what I shall call the Carson-Snyder "All-purpose" evaporator.

Mr. Snyder's plant has two independent drying units, each with its own heating system. Each of these units is two stories in height, and as the construction and arrangement of these differ materially, they must be separately described. The lower story of each unit has a central hot-air chamber, situated directly over the furnace. This chamber is without a floor, and is warmed by heated air rising from the furnace room below it. This hot-air chamber is 18 feet in length, 7 in height, 7 in width at

* Reprinted from a Bulletin issued by the State College of Washington Agricultural Experiment Station.

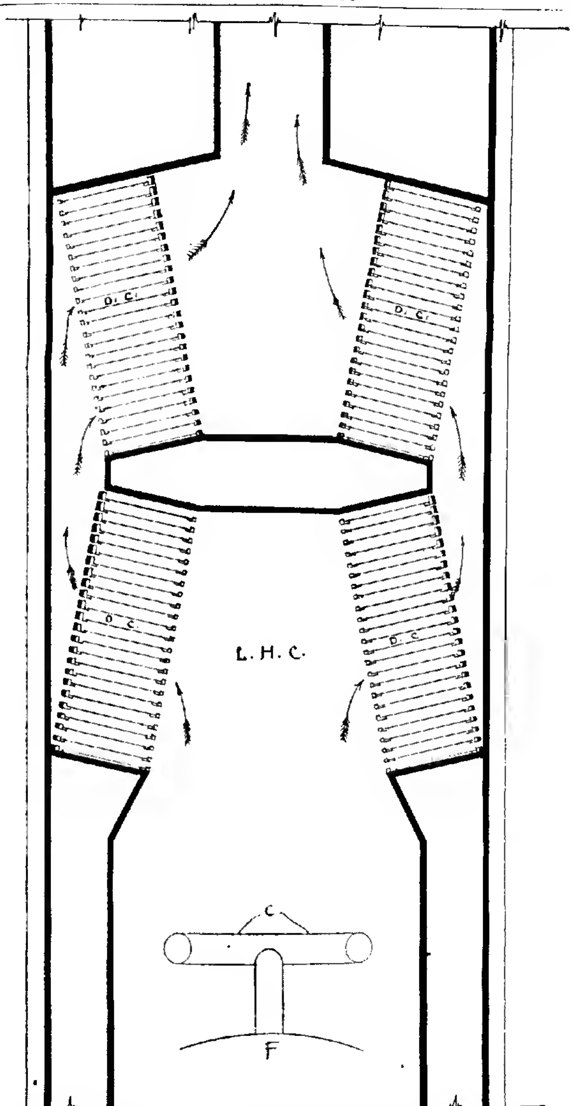


Fig. XX.—Sectional End View of Carson-Snyder Evaporator.
F., furnace. C., coils of piping. L.H.C., heating chamber. D.C., lower drying chamber, $D_1.C_1$., upper drying chamber. Direction of movement of heated air indicated by arrows.

bottom, and 4 feet in width at the top. On either side of the hot-air chamber is a drying chamber in which the trays are placed. Each of these drying chambers is 18 feet in length, 7 feet in height, and 2½ feet in width. The walls, instead of being vertical, are inclined toward the heating chamber, which is thus made 3 feet narrower at top than at bottom. Each drying chamber has 22 slat runways extending through its length, made of ½ x 1 inch slats nailed on edge to the studding. These slats are 3½ inches apart from centre to centre, and are so arranged that the outer edge of each tray is 6⅝ inches higher than the inner side. As the trays used are 1 inch in depth, there is an interval of 2½ inches between the top of the fruit in one tray and the bottom of the tray above. The inner wall of the tunnel, next to the hot-air chamber, is built of 1-inch slats, which have intervals of 2½ inches between them, and these slats are so spaced that the upper edge of each slat is just flush with the top, while its lower edge is, of course, flush with the bottom of the corresponding tray. The 2½-inch spaces between trays are thus freely open to the hot air chamber. On the outer side of the drying chamber, the wall is also built of slats, but the intervals between these become progressively wider from above downward. Above the upper tray of the series the interval between slats is only 1-12 inch in width, above the next it is increased to 2-12, above the next to 3-12, and each successive interval is wider by 1-12 inch, so that the slit opposite the outer edge of the lowest member of the series of 22 trays is 1 11-12 inches in width.

Warm air rises from the furnace room into the hot air chamber, and thence passes laterally through the openings in the walls into the drying chambers. Since there is at the opposite side of each tray a slit opening into a space outside the outer wall of the drying chamber, the air moves laterally across the face of the inclined tray, and escapes into this space instead of rising through the trays above. The tendency of the warm air to rise to the top of the hot-air chamber before passing laterally over the trays is corrected by making the inlets into the drying chamber all of the same width, while the outlets therefrom are successively wider from above downward, as already described. (See Fig. XXI.) A very uniform distribution of the warm air is thus secured, the temperatures on upper and lower trays of the series differing only by two to five degrees. Consequently, this evaporator differs fundamentally from the tunnel type in that all the fruit in any pair of chambers is kept at a uniform temperature.

The second story of each unit has a pair of drying chambers identical in size, construction, and capacity with the lower pair, but differing from them in that they are inclined outward instead of inward, and in that the outer wall has uniform air inlets 2½ inches wide between trays, while the inner wall has the graduated slits for the exit of air. The warm air, after its passage through the lower drying chamber, passes into a space between the drying chamber and the solidly-boarded, vertical wall of the unit. This space is freely open above into the space between the upper chamber and the vertical wall. Consequently, the warm air escaping from the lower drying chambers rises in this space, passes from it into the upper drying chambers, where it flows across the inclined trays to escape through the graduated slits into a central space, from which a ventilating shaft carries it through the roof. Since the central hot air

chamber and the drying chambers of the first story are solidly ceiled with matched lumber, while the second story drying chambers and the space at the base of the ventilator shaft have a tight floor, air can pass from the heating chamber to the ventilator only by passing over the trays. The whole of this ingenious arrangement will be readily understood from an examination of Figures XX. and XXI.

The upper drying chambers are, of course, much cooler than the lower ones, the difference averaging about 25 to 30 degrees. Consequently, the time required for drying apples, which is six to twelve hours in the lower chambers when these are kept at 155-160 degrees, is lengthened to practically twice the time in the upper chambers, where the temperature ranges around 130 degrees. Mr. Snyder says that in so far as he is able to determine, the upper chambers turn out a product which is in every respect as desirable as that from the lower ones.

As previously stated, Mr. Snyder's plant consists of two two-story units, each having four drying chambers. Each chamber has a capacity

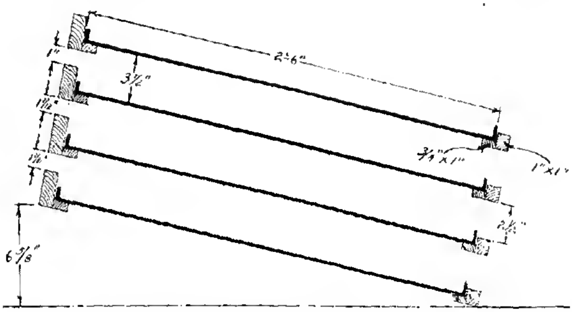


Fig. XXI. -Detail of Portion of Drying Chamber of Carson-Snyder Evaporator, showing inclination of trays toward air inlets at right, graduated air exits at left.

of 22 tiers of six trays each, each tray being 30 x 36 inches in outside dimensions. Each chamber has therefore an approximate drying area of 990 square feet, or 7,920 square feet for the eight chambers. Of this area, one half will dry apples in twelve hours or less, the remaining half in 24 hours, with a proportionate difference for other fruits and vegetables. The trays have a capacity of about 20 lbs. of apple slices each. When operated continuously with the tunnels always full, the plant has a capacity somewhat in excess of 600 bushels, or 15 tons, of apples daily, but this is not the actual working capacity, as the trays emptied during the night are not re-filled until work at the parers is begun next morning. Loganberries are spread more thinly on the trays, so that the drying chambers when filled carry 6 tons of fruit, which requires 15 and 24 hours in the upper and lower chambers, respectively. About 18 tons of prunes are required for one charge, and the time occupied in drying is 24 hours in the lower and 48 hours in the upper chambers.

A wide variety of fruits and vegetables have been dried in this plant: among the products shown the writer may be mentioned potatoes, beets,

carrots, onions, cabbage, and celery. The company has built up a considerable business in the drying and blending of vegetables for soup, so that the plant is in operation for a large part of the year.

The furnaces are built of fire brick, and extend back for the entire length of the drying chambers, with a width of 6 feet. Cord wood is burned as it comes from the forest, hence comparatively little time is consumed in firing, and one man can keep the fires going and look after the drying chambers, with occasional assistance when the fruit is being inserted or withdrawn.

Each furnace is enclosed by brick walls, which extend up to the floor of the lower drying chambers, enclosing a space over the furnace 18 feet long, 9 in width, and 11 in height. In this space there are two tiers of pipe, one above the other, to increase the radiating surface.

Movement of air through the system is secured by a series of openings in the side walls which enclose the furnaces. These openings are twelve or fifteen in number; each made by leaving out a brick in building the wall. They appear to the writer to be entirely too small to permit adequate circulation of air, and it is certain that more rapid drying would be secured were the openings increased two to four-fold in area. Since the air does not pass through a series of trays as it does in the tunnel evaporator, there is not the same necessity for rapid circulation to prevent the saturation of the air with moisture, but its sluggish movement results in greater reduction of temperature, and consequently in slower drying in the upper chambers.

This system of drying has a number of features which very strongly commend it. The most objectionable feature of the tunnel evaporator, namely, that the fruit in the upper portion of the tunnel is surrounded by nearly saturated air at a temperature many degrees lower than at the bottom of the tunnel, is entirely avoided. The objectionable features of the Charlotte and Carson evaporators have been eliminated, and their desirable characters very materially improved and perfected. The heat produced by the fuel is very fully utilized, and the plant has the advantage that the drying units can be made of any desired length, provided the size of the furnace and the radiating surface of the piping be correspondingly increased. The very satisfactory quality of the apples, prunes, loganberries, and vegetables produced is evidence that the method can be successfully used in drying any fruit or vegetable material which it might be desired to evaporate. For these reasons, the Carson-Snyder type of evaporator ought to receive careful consideration at the hands of those who desire a general purpose evaporator capable of handling a wide variety of fruits. No one should construct a plant of this kind, however, without equipping it completely with labour-saving power machinery, or it is likely to prove an unprofitable investment. It is true that Mr. Snyder's plant at Dayton operates successfully practically without labour-saving machinery, but it is unique in a number of respects. It is located in a region which produces a large volume of each of the fruits commonly evaporated, and the plant therefore has an assured supply of an exceptional variety of materials, at moderate prices, for an evaporating season of maximum length. Also, this plant has been the pioneer in the evaporation of vegetables in the North-west, and has built up a substantial business in the drying and blending of vegetables for soup stock. Consequently, the plant operates for a very large part of each year, and

fixed charges, such as interest on investment, depreciation, and insurance, are distributed over a long productive season. Fuel is cheap, and labour of an efficient character is obtainable at rates very much lower than prevail in most fruit districts in Washington. All these favouring conditions have, combined with Mr. Snyder's long experience, exceptional energy, enterprise, and business ability, to make this plant a financial success. The operator of such an evaporator in Washington will scarcely find it feasible to undertake the drying of vegetables. The supply of fruits

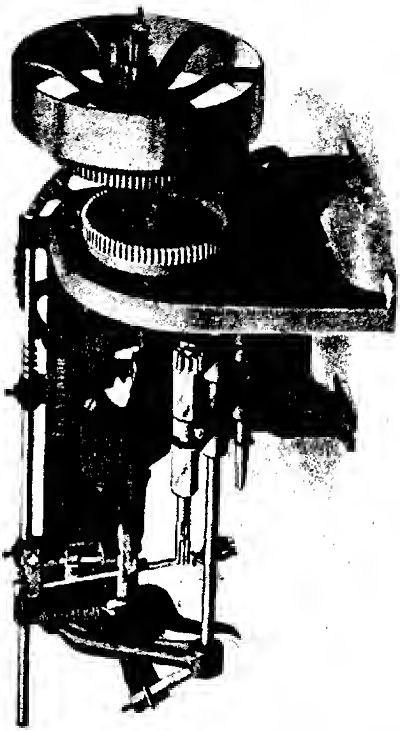


Fig. XXII.—A Popular and Efficient Type of Power Parer.

other than apples available from year to year will probably fluctuate rather widely, while the cost of fuel and labour will almost certainly be greater than at Dayton. Economy of operation may best be secured by the substitution of power-operated machinery for hand labour wherever possible, by the installation of power parers, conveyors, bleachers, and slicers. As the arrangement of the drying chambers one above the other necessitates transfer of fruit from floor to floor, an elevator and wheeled trucks for moving fruit in quantity will eliminate a very large expenditure of time and labour. There should be spreading tables on both

drying floors in order that fruit may be delivered in quantity and placed on trays near the chamber in which it is to be dried. It seems feasible to the writer to eliminate the handling of trays individually in the drying chambers by substituting wheeled trucks carrying an entire tier of trays, which could be handled as units.* Since the temperatures at bottom and top of a properly constructed and ventilated drying chamber are practically identical, the rate of drying throughout should be uniform, and a truck need not be unloaded until it has been removed and transferred to the curing room.

It may seem to the reader that undue space is given to discussion of labour-saving devices and of minor economies of operation for eliminating hand labour wherever possible. That this is not done without good reason will, perhaps, be apparent when it is recalled that the evaporation of fruit is a business in which the margin of profit is relatively narrow, and that profits depend upon the handling of large volumes of raw material, while the period in which work can go on is made a short one by uncontrollable climatic conditions. Anything which saves time or reduces hand labour increases output and lowers cost, hence widens the margin of profit. The writer has made an analytical study of a number of unsuccessful plants, as well as of many very successful ones, and can say that success is not so much dependent on the particular type of evaporator employed as upon economy of time and labour through the employment of machines. The rock upon which at least eight out of ten evaporating enterprises are wrecked is the rock of too much hand labour. The plant in which the employees spend the day in the back-breaking task of carrying boxes of fruit across the floor and up and down stairs, or in turning a hand-power slicer or hand parers, each of which needs two or three trimmers to do what the machine should have done, will be a place in which employees will shirk and save themselves. It must compete with the plant in which this heavy time-consuming work is done by power, and the ultimate result will be that the sheriff will tack a sale notice on the door. The adoption of such labour-saving devices as are here suggested, and the constant taxing of one's ingenuity to improve them and to develop others, will do more than anything else to insure a permanent business with satisfactory profits.

Evaporator Machinery and Equipment.

Paring Machines.

Paring machines to be operated by power have been brought to a high degree of perfection, and there are several standard makes of practically equal merit on the market. Among such machines may be mentioned the "Pacific No. 2," the Goodell, the "Ranger," the "Improved Triumph," and the Coons. All these are heavy, well made, durable machines, which stand up well under hard and continuous usage. The

* Such a truck need be merely a substantial base with small, heavy wheels, with a framework for carrying trays equal in height to the height of the drying chamber. The framework should be somewhat narrower than the trays, which should project at either side, and the cleats supporting the trays must be accurately spaced to correspond to the spacing of air inlets and outlets in the drying chamber. Trays should be inserted at the sides and kept in place by vertical strips at the end of the frame. When rolled into the drying chamber, the projecting edges of the trays should be just above and should overlap the runways on the inner walls of the tunnel, thus insuring lateral movement of the air. If substantially built and properly braced to prevent warping, such trucks would soon pay for themselves in the saving of time and effort they would accomplish.

illustrations show the general plan of all such machines in that there are three forks; an apple is cored and discharged from one of these while that upon a second fork is being peeled, the operator meanwhile placing the fruit upon the third. While the claim is made by some makers that their machines have trimming attachments which make hand trimming unnecessary, it must be said that the writer has seen no machine which can do more than reduce the work of trimming by one-half when working with good fruit, or by, perhaps, one-third when small, irregular apples are being peeled.

There are a number of good machines to be operated by hand; nearly every maker of evaporating machinery in the list given below makes a machine which has been proven satisfactory.

Slicers.

Several power slicers, among which may be mentioned the Boutell, the "Rochester," the "Ontario," the Evans, and the Goodell, are widely used, and strongly recomended by users. Such machines are of two types, the under-cut, in which the knives which slice the apple pass beneath the fruit, and the overcut, in which the exact opposite is the case. A defect common to all overcut machines, in so far as the writer is acquainted with them, arises from the fact that the apple is permitted to roll somewhat before the knives, with the result that some fruits are sliced at oblique angles with the core hole, or even parallel with it, while a larger percentage of slices are broken than is the case in the undercut machines. Most of the companies making power machines make also smaller machines to be operated by hand power. The illustration represents a good type of undercut power slicer.

Graders.

A good grader is a necessity in every evaporator; a larger output per day will be handled by the parers and trimmers if fruit is separated into sizes before paring, and a better price will be obtained for the product if the larger fruits are worked up together, since price depends, to some extent, upon size of rings. Since a grader is likely to be available as a piece of orchard equipment already in hand, no one should attempt to handle apples of all sizes indiscriminately mixed together.

Other Equipment.

The construction of a good type of power bleacher has already been discussed. Any large wholesale hardware company can supply gearing, chains, and other metal parts, and the wooden portions may be made by a good carpenter at a considerable saving over the prices charged by the supply companies. The same statement holds true of conveyors, tables, and all the wooden parts of the paring-room equipment; it may be made on the premises, only the shafting, belting, and gearing need be purchased, and the whole installed by any good mechanic.

The list of companies given below not only manufacture hand and power parers and slicers, but also manufacture or handle belting for conveyors, castings, and chains for bleachers, and practically everything

needed for the equipment of an evaporating plant with power machinery:—

Boutell Manufacturing Co., Rochester, New York.
Goodell Manufacturing Co., Antrim, N. H.
Fruit Machinery Co., Ingersoll, Ontario, Canada.
Coons-Mabett Manufacturing Co., Rochester, N. Y.
Evans and Co., Medina, New York.

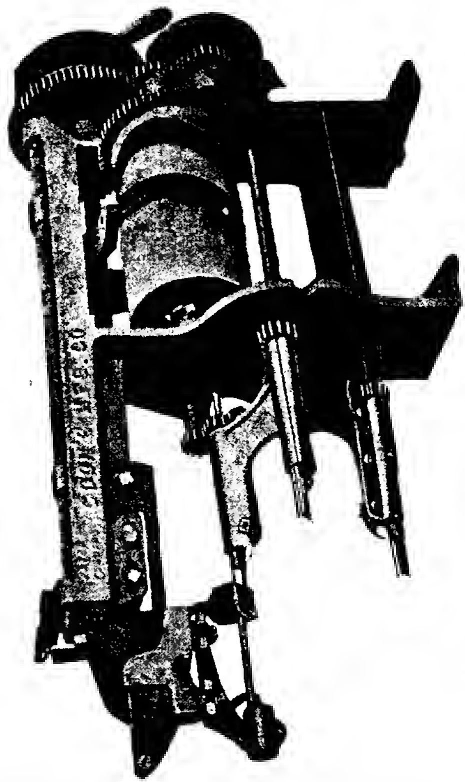


Fig. XXIII.—A Power Parer having an Automatic Trimming Device.

Temperatures at which Drying should be Conducted.

It must be said in the outset that no chemical studies of the changes occurring in fruits dried at different temperatures have ever been made, and we have at present no knowledge as to the extent to which loss of flavour, of solid constituents, conversion of starch into sugar, or other chemical changes occurring during drying can be controlled by controlling temperature. In the absence of such knowledge, the recommendations made here are simply those in which the great majority of

evaporators concur. They have been worked out empirically by practical evaporators who found that best results were obtained when the temperatures suggested were used, and may need modification when exhaustive studies of the whole subject have been made.

In the kiln evaporator, at least 95 per cent. of operators maintain a temperature of 155-165 degrees for the first five or six hours after the kiln is filled. If the temperature is raised higher than the second figure named, the cellular structure of the fruit is destroyed by expansion of the contained vapour and serious loss of sugar by bleeding occurs; unless the temperature is kept up to this level, the surfaces of the fruit become slimy, and the subsequent drying is retarded. After the first five or six

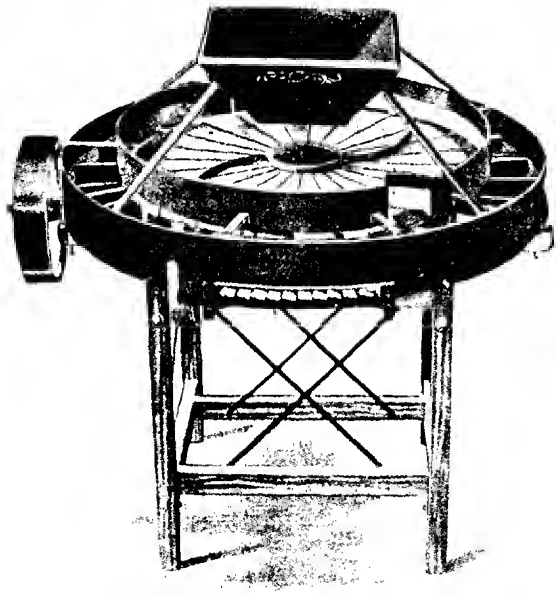


Fig. XXIV.—An Efficient Under-cut Power Slicer of Large Capacity.

hours, some operators allow the temperature to go down to 130 or 135 degrees, open the ventilators widely, and continue the drying by using large volumes of air at lower temperature for ten to twelve hours, after which the temperature is brought up to 175-180 degrees, and kept there until the drying is completed. Users of this method claim for it that it is economical of fuel—a claim which seems to be well established—and also that it makes a more springy, "lively" product, which resists exposure to unfavorable conditions much better than fruit dried with a uniform temperature. This second claim does not appear to be fully substantiated, and most operators carry the fruit through the whole process at a temperature of approximately 160 degrees.

In the tunnel evaporator, the majority of operators maintain a temperature of 160 to 175 degrees in the lower and hotter end of the tunnel, while the upper end will be 15 to 25 degrees cooler. Since the fruit is introduced at the upper end, and gradually moved toward the hotter end, it begins to dry at 135 to 150 degrees, and is finished at the higher temperature. This is essentially what the operator of the kiln accomplishes by the first method described in the last paragraph.

In the Carson-Snyder evaporator, a very different set of conditions prevail. Since the temperature in the upper drying chambers is usually 25 or 30 degrees lower than that in the lower ones, it follows that the fruit placed in the upper chamber is dried at a temperature considerably lower than that used in any other evaporator. In physical characters and appearance it is indistinguishable from other fruit, and, as already stated, we possess as yet no information as to whether chemical differences exist.

In drying prunes and berries, the temperature at the outset should not be allowed to rise about 125 or 130 degrees until the fruits have lost a considerable portion of their water, as otherwise there will be expansion and bursting, with consequent dripping. The temperature which may be employed in the later stages of the process will depend upon the circulation of air; if ample air movement can be obtained a temperature of 175 to 180 may be employed in the last half of the drying period, but if the circulation of air is defective the temperature must be kept below this point, or the fruit will be partially cooked, or dried at the surface, while the interior is still too high in water content.

Relation of Temperature of the Air to its Moisture-carrying Capacity.

It must not be forgotten that the capacity of the air to carry moisture is a function of its temperature, and increases rapidly as the temperature is increased. How significant this fact is may at once be seen from consideration of the fact that 1 cubic foot of air at the freezing point can absorb 1-160 part of its weight of water, and that the water-absorbing capacity is doubled with every increase of 27 degrees in temperature. This is shown in the following table:—

Temperature.	1 cubic foot of air can absorb—
32 degrees	1-160 its weight
59 degrees	1-80 "
86 degrees	1-40 "
113 degrees	1-20 "
140 degrees	1-10 "
167 degrees	1-5 "
194 degrees	2-5 "
221 degrees	4-5 "

If we disregard the expansion of air with increasing temperature, which we may do since it amounts to only 1-190 of the volume for each degree rise of temperature, it will be seen that air raised from 86 degrees to 167 degrees has had its moisture-carying capacity increased eightfold, whereas if the temperature be raised to 140 degrees the moisture-carrying capacity will be increased only fourfold. It is, therefore, easily seen that in drying any substance not easily injured by heating choice may be made between the use of a very large volume of air moderately heated or a much smaller volume of air raised to a higher temperature.

The fact that under ordinary conditions the rate of movement of the air over fruit cannot be brought under the control of the operator necessitates the use of higher temperatures in order to bring the time required for drying within reasonable limits.

Artificial Means of Increasing Circulation of Air.

The operator of a tunnel or Carson-Snyder evaporator who finds that the circulation of air through the fruit is sluggish may increase it to any degree desired by installing suction fans in the ventilating shafts, or by employing a ventilating fan to drive air into the furnace-room, over the furnace, and upward through the fruit. In the case of a kiln, only the second method could be used, since the air movement produced by a suction fan would be mainly through the centre of the kiln, and there would be margins along the walls in which drying would be very slow. Fans may be connected up with the main power shaft, and operated constantly, or brought into service only on such still, humid days as make satisfactory drying without their help impossible. Since their use will necessarily lower the temperature of the air, the operator must bear in mind what has just been said in regard to the relation of temperature to moisture-carrying capacity in determining the speed at which his fans shall run.

Determining When the Fruit is Properly Dried.

Fruit should be removed from the kiln floor or drying trays when it still contains slightly more moisture than the finished product is to have. The ability to judge accurately as to when the fruit has reached the proper condition for removal can only be gained by experience, but some general statements may be made. Fruit which is sufficiently dried for removal should be so dry that it is impossible to press water out of the freshly cut ends of the pieces, but should be sufficiently elastic not to break when the piece is rolled into a cylinder. When a mass of slices are pressed firmly into a ball in the hand, they should separate at once when released. The surface should be soft and should adhere slightly to the fingers, leaving the hands "sticky" after handling them. Occasional slices will, of course, have more or less than this amount of moisture, but the general condition of the fruit should be that just described.

When the fruit has reached this condition, it should be removed to the curing room, where it is spread upon the floor to a depth of a foot or more. Here the moisture content of the whole mass gradually becomes equalized, a process which should be accelerated by stirring it thoroughly once a day. A slow loss of moisture content will go on for some days or weeks, reducing the fruit as a whole to a weight 4-5 per cent. less than it had on coming from the drier.

Grading and Packing the Dried Fruit.

The trade recognises four standard grades of evaporated apples, which may be briefly defined. "Extra Fancy" is a name used to designate the highest quality fruit, and consists of very white fruit in complete rings of large size, with only a very small admixture—5-8 per cent. at most—of broken pieces. It must be free of bits of skin and core, and must be perfectly clean. "Fancy" is also a clean white stock without skin or core, but may consist of somewhat smaller rings with a somewhat larger proportion of broken pieces. "Choice" is, on most

markets, a slightly darker, somewhat golden stock made from apples of high sugar content, reasonably free of skin and cores, and with 60 to 70 per cent. of the slices in perfect rings. "Prime" is a designation for fruit which, while fairly white, has more broken pieces, peel, or seed cells than are permissible in the "choice" grade, or which is reasonably free of these but is dark in colour. A fifth grade, called "middling" or by various other names, receives all fruit which has been so badly trimmed and cored that it cannot be admitted to "prime," which contains too large a proportion of broken rings and chips, or which has been badly bleached and is consequently very dark in colour.

The best evaporators make several grades of stock from the same lot of apples, by grading the fruit prior to peeling and slicing, and drying large and small fruits separately. When a power slicer is used, the separation into grades is carried further by dividing the chute from the slicer by partitions, so that the large slices from the centre of the apple pass into one receptacle while the smaller slices from the ends pass into another and are separately dried. When packing begins, the fruit is again sorted over, the largest perfect slices being put together as extra fancy, those also perfect but made from smaller fruits going into fancy, while the smallest slices are put together into prime, and only the broken bits of ring slices with adhering seed cells or skin, and pieces with other imperfections, along with badly bleached fruit, remain to fall into the lowest grade. Such care is well repaid by the higher prices which will be received for the perfect fruit of the upper grades.

In packing the fruit, wooden boxes containing 25 to 50 pounds are used for all grades above prime, while prime and middling are more frequently sacked in bags containing 50 to 100 pounds. A fifty-pound box is usually 22 x 11 x 10½ inches, while the twenty-five-pound box is 18 x 9 x 9 inches, inside dimensions. These boxes are made with a loose side which becomes the bottom, not the top, of the box when it is filled. Packing is begun by "facing" the future top of the box with a layer of perfect slices of good size, which are laid in overlapping fashion, like the shingles on a roof, over the entire surface, after lining the box with paraffined paper which usually has a fancy lace edge. After the "facers" are in place, a second box of the same size but with both bottom and top removed is placed over the first one, and fruit is packed in by hand until the desired weight is reached, when the box is transferred to the platform of a hand press, a board slightly smaller than the inside dimensions of the box is placed on top, and pressure is applied until the fruit is forced down sufficiently to permit the bottom to be nailed on. The package should be finished by stenciling thereon the maker's name and address, with the weight, grade, and the variety of fruit from which the product was made. A guarantee covering these facts may advantageously be added.

Varieties Best for Evaporation.

Since the prices of evaporated apples in the markets depend upon the colour of the product as well as upon the care employed in its manufacture, those varieties which make the whitest product are most desired by evaporators. In the East, Baldwin holds first place in this respect. Spitzenburg and Ben Davis make as white stock as Baldwin, and will undoubtedly take rank among Northwestern evaporators corresponding

to the Baldwin in the East. Winesap, Delicious, Jonathan, Black Twig, Rhode Island Greening, Rome Beauty and Stayman Winesap will make a slightly less white, faintly golden stock, and will rank together in second place, while Roxbury Russet, Missouri and Yellow Newtown, Gano, Wagener, and Grimes Golden will be ranked as the "dark stock group" by reason of the fact that the fruit made from them will be a distinctly golden colour which will command in the markets a price slightly below that of the whiter stocks.*

Yield of Dry Fruit from Different Varieties.

It may be said at the outset that colour and weight of dry product are both directly dependent upon the sugar content of the variety used; that such varieties as are characteristically low in sugar content will give the desired white stock, but will give small yields of dry product, while varieties high in sugar content will give a larger yield of a product of darker colour.† Of the apples named in the "white stock group" above, it may be said that an average yield of dry fruit from Baldwin, Spitzenburg, or Ben Davis will be 13 to 13½ pounds per hundred pounds of fresh fruit; for the second group—Winesap, Jonathan, Black Twig and Greenings, the yield will be, on the average, 13½ to 14½ pounds per hundred, while Russets, Grimes Golden, and the others named with them as the "dark stock group" will give a yield of 14½ to 16 pounds of dry fruit per hundred. In all cases, these figures apply to mature apples of C grade or good culls, dried to a water content of 25 per cent. Windfalls and immature fruits will make a slightly lighter product, as they must have the water content reduced to a lower percentage in order to prevent spoiling.

In this connexion it may be of interest to state the result obtained by Mr. D. A. Snyder, of the Dayton Evaporating and Packing Co., who dried during the past season a number of lots of apples sent him from Spokane, from points in Idaho, and from Portland, Oregon, for the purpose of making comparative tests of yields. The results follow:—

Variety	Grade	Origin	Dry Fruit per 100 lbs.
Arkansas Black	C	Idaho	12.84
Arkansas Black	Culls	Idaho	12.75
Ben Davis	C	Idaho	13.12
Ben Davis	Culls	.. ..	12.54
Rome Beauty	C	Idaho	12.91
Rome Beauty	Culls	.. ..	12.49
Winesap	C	.. ..	12.96
Winesap	Culls	.. ..	12.70
Wagener	C	Spokane	13.36
Wagener	Culls	Spokane	14.63
Ben Davis	Culls	Portland	13.09
Ben Davis	B	Portland	14.68

* Mr. J. Farrell, of the Victorian Department of Agriculture, supplies the following note:—Apples with white flesh yield the most attractive product, but a well-dried mixture of several varieties is usually of good quality and appearance. Under ordinary conditions it is not desirable to cultivate special sorts for drying. The only variety which I have heard of as having been rejected for drying purposes is Morgan's Seedling and this is considered unsuitable, not on account of its quality, but rather because it is too small to handle profitably.

† Since summer varieties are, as a class, very low in total solids and in sugar, the yield of dry fruit is so small that it is impossible to evaporate them with profit. For this reason no summer varieties are mentioned in this discussion.

These results would indicate that the yield of dry fruit from a given variety grown in the Northwest is practically what the same variety yields in other apple-producing regions of the United States. Extensive comparative studies of the chemical composition of the leading varieties of apples when grown under the various conditions of rainfall and irrigation occuring in the Northwest are badly needed. Such studies have thus far been made only for Idaho apples. Jones and Colver, of the Idaho Experiment Station, have made extensive series of analyses* of the chief varieties of apples and other fruits grown in that State, with and without irrigation, and the results strongly indicate that there is no substantial ground for the widely current statement that North-western apples are higher in water content, lower in sugar and total carbohydrate content, and lower in nutritive value than apples grown in other sections of the United States. While the variations in composition of any given variety shown by the analyses of Jones and Colver are very considerable, equally great variations are found when analyses of varieties grown in other regions are compared, and the averages of any two sets of analyses made in different portions of the United States fall very nearly together when compared. Consequently, no one need give credence to statements to the effect that North-western apples will yield a materially smaller quantity of evaporated product than is obtained from the same varieties in the East.

* Jones, J. S., and Colver, C. W., *The Composition of Irrigated and Non-irrigated Fruits.* Bull. 75. Idaho Agric. Exp. Sta. 1912, p. 54.

In spite of the fact that abundance of blossoms is produced, it sometimes happens that our orchard trees fail to bear fruit. The failure is due to one or more of several causes, which a bulletin of the Colorado Experiment Station summarizes as follows:—

First.—Many varieties of apples and pears are self-sterile. That is, they are not capable of setting fruit properly unless pollen from another variety is used. For example, Bartlett and Kiefer pears, in many locations, when they are planted in solid blocks, give less satisfactory results than when they are planted with such varieties as Lawrence, Duchess, and Anjou. With apples and pears it is good practice to mix varieties. However, if varieties with proper affinities are selected, one variety to furnish the pollen is as good as a number.

Second.—The pistil, the part of the flower to develop fruit, is more easily frozen than other parts of the flower. Hence the pistil may be frozen while other flower parts are not affected; consequently, blossoms are formed, but fail to set fruit.

Third.—Trees in a weak condition, although blooming abundantly, often fail to set fruit.

Fourth.—The pistil may be mechanically injured, and the pollen washed away by rain at the time when blossoms are open.

Fifth.—Blossoms often drop in great numbers when the tree is forming an excessive amount of wood.

Sixth.—Over-abundance of nitrogen fertilizers.

Seventh.—Diseased buds.

Eighth.—Heavy spraying of trees, especially before pollination has in some few instances resulted in a loss of blossoms. This is not serious, however.

THE ALGAROBA TREE.

By Alfred J. Ewart, D.Sc.

The name of Algaroba Tree was formerly more commonly applied to the plant known scientifically as *Ceratonia siliqua,* which bears somewhat sweetish edible fruits. At one time these fruits, when dried, were sold in England—at any rate, in Lancashire and in the north of England—under the name of "locusts," but they seem now to have gone out of fashion as a sweetmeat for children. Similarly in Victoria the pods of the *Robinia pseudacacia* are considered a food, or rather a luxury, by the young people of the districts where the tree grows.

The Algaroba Tree, to which so much attention has been recently drawn in Victoria, is the plant known to botanists as *Prosopis juliflora.* It has been known also as *Prosopis dulcis,* on account of its sweetish pods. On good soils it becomes a handsome tree, and grows to a height of 50 or 60 feet, with a hard, strong, handsome and dark-coloured wood. Further, it has the advantage of being capable of growth under very varied conditions, and although it will stand a moderate amount of drought, it grows really well only where a steady supply of moisture gets to the roots, or when the roots succeed in reaching a permanent water supply. In these conditions it will thrive in a dry district with a small rainfall; and since it can stand a slight degree of salinity, it would be a useful tree to plant around artesian bores and wells in country subject to drought.

At the same time, it is necessary to point out that the prevailing idea that the tree would be a valuable standby for cattle in dry seasons is scarcely correct. At any rate, there are many native trees whose foliage would be more useful to keep stock alive when feed is scarce. The value of these native trees has been tested during past droughts, and one result is that some of the species are becoming extinct. Perhaps the most notable instance is that of the "kurrajong," *Brachychiton populneus,* in the Upper Murray district, but other cases are common.

It should also be borne in mind that comparatively little fruit will be available at any given time, unless it be stored, and thus the cost will be greater than if, instead of Algaroba Trees, a fodder crop were grown and stored as hay or silage. Further, it should be pointed out that although a tree may bear a great mass of foliage or fruits, it produces more inedible matter than does a herbaceous plant like lucerne, and comparing yields per acre per annum, lucerne is much superior to any fodder tree.

It is curious to note how particular plants from time to time come under notice as fodder plants, and are praised to an extent far above their actual merits. For instance, the "Burr Medick" had a boom of this kind nearly ten years ago. It was followed by the King Island Melilot, and then by the so-called *Phalaris commutata,* which was supposed to be a new plant, but which was found to be nothing more than an old, long-known plant, *P. bulbosa.* At another period Peruvian lucerne became the craze, to the exclusion of equally good, or even better, varieties of lucerne, and at present Sudan grass is attaining a prominence far above its real merits.

An interesting point is that these occasions seem to follow in cycles. Thus the King Island Melilot had a temporary boom some thirty years ago, shortly after its first appearance in Victoria, and a second one comparatively recently, when it was first given the name of King Island Melilot.

In the case of the Algaroba Bean, the first boom seems to have been forty years ago, and the following correspondence concerning it may be of interest:—

Royal Gardens, Kew, May 4, 1877.

Sir,

In reference to my letter, February 20, I am desired by Dr. Hooker to transmit to you the enclosed copy of a letter from the Superintendent of the Botanic Garden in Jamaica, pointing out the necessity of caution in the use of the pods of the *Prosopis pubescens* for the purpose of feeding horses.

I am, sir, your obedient servant,

W. T. Thiselton Dyer.

W. R. Guilfoyle, Esq., F.L.S.,
Director, Botanic Gardens, Melbourne.

Cinchona Plantations, Jamaica, April 6, 1877.

Sir,

I have to acknowledge the receipt of your letter dated 20th February last, informing me of the dispatch of two bags containing about eight lb. of the pods of *Prosopis pubescens*, which I have also received, together with printed correspondence on the subject of these seeds.

Some 5 per cent. of these seeds germinated; accordingly we will have about 100 plants altogether.

Consequent on the favorable recommendation conveyed in the aforesaid correspondence of the pods for horse and cattle food, and as only a small proportion of the seeds were in a state fit for germination, I, by way of experiment, gave about a pound of the pods to a fine healthy horse. In the morning of the third day after the pods were given to the horse the animal was found dead in the stable, and lying in such a position that left no reasonable doubt that it had died from bellyache. There are, therefore, strong grounds for believing that the horse thus died from the effects of these pods.

I presume you are aware that another species of this genus, viz., *Prosopis juliflora*, a very common plant in Jamaica, the pods of which (although a valuable fodder) when eaten by horses, but especially after rains, are almost invariably the means of causing severe bellyaches and very frequently death. This is attributed to the germination of the seeds in the stomach of the animal.

Probably the above remarks may be of service by way of caution to other colonies in which this plant is proposed to be cultivated.

I am, sir, your obedient servant,

Robert Thomson.

W. T. Thiselton Dyer, Esq.,
Royal Gardens, Kew.

Although from the above letter the pods would seem to be dangerous to horses, they appear to be less dangerous in the case of ruminating animals like cattle or sheep.

To sum up, if the Algaroba Trees are planted for shelters, windbreaks, and ornaments to the landscape they will be useful. If they are sown with the idea of using the pods as cattle food, they will be of some slight use, but the yield will be far less than if the same area of ground had been placed under fodder crops. If they are simply grown to be cut down for feed in time of scarcity, they are taking the place of trees more valuable for this purpose, and will merely represent a very costly and inefficient way of providing reserve stores of fodder.

INTER-STATE CONFERENCE OF AGRICULTURAL SCIENTISTS.

A Conference, attended by agricultural scientists from all the States, convened by the Federal Government at the instance of the Advisory Council of Science and Industry, was held in Melbourne from 9th November to 16th November, 1917. Professor A. J. Perkins, Director of Agriculture of South Australia, presided. A number of papers dealing with different aspects of agricultural science were read before the Conference, and valuable discussions took place on each subject. The papers, with a summary of the discussions, will shortly be published by the Advisory Council. The topics dealt with were as follows:—

Wheat breeding (introduced by H. Pye, Victoria); oats and barley breeding (J. T. Pridham, New South Wales); maize breeding (H. Wenholz, New South Wales); statistical methods applied to plant breeding (Dr. W. H. Green, Victoria); production of cereals for arid districts (A. E. V. Richardson, Victoria); immunity and inheritance (D. McAlpine, Victoria); plant acclimatization (G. L. Sutton, Western Australia); utilization of Australian phosphate deposits (Professor J. W. Paterson, Western Australia); tobacco culture (T. A. J. Smith, Victoria); utilization of native grasses and fodder plants (E. Breakwell, New South Wales); fibre crops (T. Hogg, Victoria); sugar crops (H. T. Easterby, Queensland); crops for production of power alcohol (W. R. Grimwade, Victoria); suggestions as to Commonwealth endowment of agricultural research (Professor A. J. Perkins, South Australia); agricultural research and co-ordination of effort (Professor R. D. Watt, New South Wales).

The following resolutions were carried by the Conference, and have been forwarded to the Executive Committee of the Commonwealth Advisory Council of Science and Industry:—

1. This Conference recommends to the Executive Committee of the Advisory Council that a "Seed Improvement Committee" be formed under the Council.

This Commitee should, among other matters, deal with—

(*a*) The nomenclature of cultivated varieties of farm crops.
(*b*) The elimination of undesirable varieties of crops.
(*c*) The exchange and dissemination of seed samples for research work.
(*d*) The recommendation of money grants to approved State or other institutions for work in connexion with seed improvement and the introduction of improved varieties of crops.

2. That in view of the benefits to be derived from the systematic introduction of seeds and plants into the Commonwealth, and to insure more economy of effort in this direction on the part of all the States, this Conference is of the opinion that as soon as practicable a Plant Introduction Bureau should be established, the functions of which would include—

(1) Arrangements for the introduction of new and useful agricultural plants from other countries into the Commonwealth;

(2) The systematic testing of these introduced plants in co-operation with State experiment farms.

(3) The systematic recording of the results of such tests.

3. That this Conference recommends that each State Department of Agriculture should continue or initiate the work of improvement and selection of its cultivated crops as part of its regular work, and that such work of improvement be on uniform lines in all the States.

4. That the rust in cereals, particularly black rust in wheat, which is common in all the States, and in some seasons largely reduces the yields, be made the subject of a special investigation in connexion with plant breeding.

5. That the Executive Committee of the Advisory Council be asked to arrange for an annual meeting of plant-breeders from the different States with a view to co-ordinating their work and arriving at a uniform policy without interfering with individual methods, the meeting to be fixed at a convenient season of the year (July).

6. That this Conference recommends the establishment of an organization to deal with the collection, propagation, improvement, and cultivation in suitable areas of the most promising indigenous grasses and fodder plants.

7. That this Conference recommends to the Advisory Council of Science and Industry the advisability of closely investigating the tobacco industry in Australia, both in the interests of the producer and with a view to retaining locally the profits of manufacture.

8. That in view of the high prices ruling for fibre products and the desirability of making Australia self-contained in the production of fibre, the Conference recommends the Advisory Council of Science and Industry to make a thorough investigation into the possibilities of fibre cultivation in Australia, particularly flax and sisal hemp, and the possibilities of producing these fibres for local manufacture or for export.

9. That the Advisory Council of Science and Industry be asked to ascertain whether the British Government would be prepared to purchase dew-rotted flax fibre from Australia in 1919; and, if so, what quantities and at what price f.o.b.

10. The Conference is of opinion that the prospect of commercial production of power alcohol from certain crops is promising, and suggests that special experiments shuld be arranged by the Advisory Council of Science and Industry to determine the actual yields of alcohol obtainable from these crops, including sorghums in various stages of development.

11. That this Conference welcomes the proposal of the Advisory Council to investigate the utilization of Australian phosphates, and suggests that this investigation should include manurial trials, particularly on pasture lands, in those of the States which possess such phosphates.

12. That in view of the need for a supply of scientific investigators into agricultural and pastoral problems, the Advisory Council of Science and Industry be requested to direct the attention of the various Australian Universities to the subject.

13. In view of the prominent position occupied by the United States of America in scientific and practical agriculture, and of the similarity of the climatic and economic conditions of that country to those of Australia, this Conference recommends the early appointment of a per-

manent agricultural representative from Australia to the United States, whose duties should include keeping Australia in touch with improved scientific and practical methods in agriculture and the supply of promising varieties of cereals and other hops.

14. That this Conference expresses its appreciation of the action of the Executive Committee of the Advisory Council of Science and Industry in calling it together, and is confident that the opportunity of meeting and consulting together thus afforded to agricultural scientists from the different States will be beneficial to agricultural progress in Australia.

BULLETINS FOR STOCK-OWNERS.

The Commonwealth Advisory Council of Science and Industry has just published a bulletin which will be of much interest to stock-owners and to those connected with trades dependent on cattle for their raw materials. The bulletin consists of the report of a Special Committee appointed by the Council last year to review the whole position of the tick pest, present and future, and make recommendations both as to future scientific research and as to immediate remedial or preventive measures, whether by legislation or otherwise. The Committee consisted of authorities on veterinary science, stock inspectors, and representatives of the pastoral industry, and its recommendations are therefore authoritative and worthy of careful consideration by the Governments and persons concerned.

The first portion of the bulletin contains an account of the cattle tick itself, the diseases to which it gives rise in cattle, and a history of the spread of the tick in Australia. Maps of the present distribution of the tick in Queensland and New South Wales show that the whole of the coastal areas of the former State and the north-east corner of the latter are now tick-infested. The bulletin next gives a review of the losses, direct and indirect, which have been caused in Australia by the tick invasion. The Committee states that if the enormous toll the tick pest has exacted from the Commonwealth could be expressed in figures, the total amount involved would stagger the community. Each year, so long as it is allowed to continue, the pest will enforce a heavy penalty, to be met not only by the stock-owners, but by all interested in business directly and indirectly dependent upon the cattle industry, as well as by members of the general public in the increased cost of necessary commodities such as meat, milk, butter, bacon, &c. After describing the methods of eradication adopted in America and Australia, and giving a summary of the campaign for tick eradication in the United States, which has been successful in freeing over 260,000 square miles of country from the tick, and thus affords promise for similar action in this country, the Committee makes specific recommendations as to the action that should be taken in Australia. These recommendations fall under two heads, (i) that a campaign for eradication should be undertaken under Federal control; (ii) that further researches on the

tick, its life-history, and the nature of the tick-fever should be carried out in Australia.

The Executive Committee of the Advisory Council has indorsed these recommendations, and has already announced that researches on the life-history of the tick will be undertaken immediately in Southern Queensland.

Another bulletin which has been issued by the Executive Committee of the Commonwealth Advisory Council of Science and Industry contains a number of valuable reports and articles on the nodule disease of cattle.

The first section of this bulletin consists of the report of a special committee appointed by the Council which met in Sydney last year. This report deals first with the economic aspect of the question, and figures are quoted which show that the annual loss caused to the Australian meat industry by the parasite *Onchocerca gibsoni*, which causes the worm-nodules, amounts to over £500,000. This loss is due to the fact that under an agreement with the British Government the Commonwealth authorities have agreed not to allow the export of the briskets, in which the nodules are commonly found, and these portions of the carcasses are removed, and, in the main, wasted. The Special Committee considers that an unnecessary amount of economic loss, both directly and indirectly, is entailed by the present regulations for export, and considers that the Commonwealth Government and the British authorities should confer, so as to arrive at some practicable means whereby such waste of food may be prevented as far as possible, and so benefit both the British consumer and the Australian Commonwealth.

In another article contained in the bulletin, Dr. Georgina Sweet deals with the occurrence of similar worm-nodules in countries other than Australia, and shows that they are found in many localities in Southern Asia, whilst they have recently been discovered in South America, and are reported to occur also in North America. These facts are of great importance, since the present British regulations discriminate against Australian beef, and when they were framed it was thought that worm-nodules were peculiar to Australia. Another powerful argument is thus provided in favour of a revision of the existing regulations for the export of meat from Australia to Britain.

The method by which the cattle become infected with the nodule-forming worms is still a mystery, in spite of prolonged research. Opinions differ as to whether the discovery of the means of transmission of the parasite would be likely to lead to results of economic importance, but it is obvious that, until this is known, any attempt at quarantining cattle or attacking the disease would be impracticable. An account is given in the last portion of the bulletin of the most recent researches on the subject. Drs. Cleland and Dodd and Mr. McEachran, experimenting in Sydney, incline to the opinion that the disease is spread by march-flies biting the cattle. Up to the present they have not been able to prove this, but a Special Committee is still working on the problem with a grant from the Advisory Council. Experiments conducted in the Northern Territory were negative, but make it doubtful whether, in that locality, at any rate, flying insects of any kind can be the vectors of the disease.

Copies of both bulletins will be supplied, post free, on application to the Secretary of the Advisory Council, 314 Albert street, East Melbourne.

CAPACITIES AND SPECIFICATIONS FOR MAKING VATS FOR CHEESE FACTORIES AND DAIRIES.

By G. C. Sawers, Cheese Expert.

Capacity in Gallons.		Dimensions—Inner Vats.						Thickness of Timber.
100	..	4 feet	×	2 ft. 9 n.	×	18 inches deep	..	$1\frac{1}{4}$ inch
200	..	8 feet	×	3 feet	×	18 inches deep	..	$1\frac{1}{4}$ inch
300	..	11 feet	×	3 feet	×	18 inches deep	..	$1\frac{1}{2}$ inch
400	..	12 feet	×	3 feet	×	20 inches deep	..	$1\frac{1}{2}$ inch
500	..	14 t. 6 in.	×	3 ft. 8 in.	×	20 inches deep	..	$1\frac{1}{2}$ inch
650	..	16 ft. 6 in.	×	4 feet	×	20 inches deep	..	2 inch
750	..	16 ft. 6 in.	×	4 ft. 4 in.	×	21 inches deep	..	2 inch
800	..	17 feet	×	4 ft. 6 in.	×	21 inches deep	..	2 inch
850	..	18 feet	×	4 ft. 6 in.	×	21 inches deep	..	2 inch

The wood used for body is to be well seasoned kauri, from $1\frac{1}{4}$ to 2 inches in thickness, depending on the capacity, chamfered at ends and sides, and screwed together with 3-in. screws, and each end tied with two $\frac{1}{2}$-in. iron rods and nuts, set into the wood flush, the upper edges of the sides and ends to be turned convex. Bottom to be of kauri, from 1 to $1\frac{1}{2}$ inches in thickness, tongued and grooved; white lead to be placed in between joints; the whole to be clamped up, and then screwed to the body, and made thoroughly water tight.

Legs, six in number—four of equal length (2 ft. 10 in.), and two at one end, 4 inches shorter, to which two blackwood levers are to be attached with bolts and nuts, bolts to be placed inside short pieces of $\frac{3}{4}$-in. pipes, in order to prevent them from damaging the wood. These levers are used for tilting the vat to suit slope of the floor.

Steam pipes and fittings, used in bottom of wooden vat, to consist of $\frac{1}{2}$-in to $\frac{3}{4}$-in galvanized pipes, elbows, **T** joint, couples, screw nipple, two back nuts, two washers to correspond.

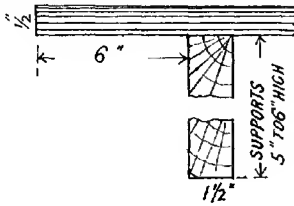
A hole 1 inch is to be bored in the centre of the body end, opposite end from tap, close on the bottom ledge, to enable the nipple connecting with the main centre pipe to pass through, and nipple is to be screwed into couple, with back nuts and washers inside and out, and screwed up tight against the wood to prevent any leakage.

Screw to nipple that is projecting outside elbow, or bend with couple for connecting inlet steam pipe. This pipe should be from 6 inches to 1 foot in length, attached to end with brass union joint, for disconnecting in the event of the steam valve leaking steam, and taking the pressure of the main steam pipes when tilting the vat.

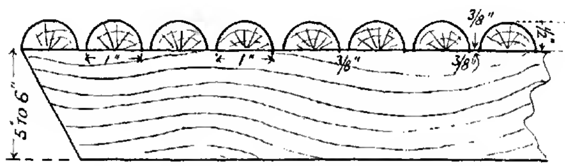
Top frame to be from 2 to 3 inches oregon, with four handles to lift steel vat out of and into wooden body, the lower sides and ends of the frame grooved concave, to insure frame sitting closely and firmly in position.

Inner vat of 18 to 20 gauge tinned steel overlapped 1 inch, and joined with rivets not more than 2 inches apart, and thoroughly floated on both sides with solder, with flush joints inside, and flanged over top frame, and $\frac{1}{2}$ inch down on the outside, and tacked down all round with $\frac{1}{2}$-in. clout tacks.

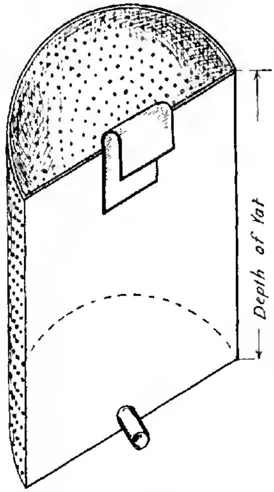
Slats, 3 inches x 3 inches, to be set on wooden bottom, and cut out before putting into position, 9 inches to 1 foot, to fit over the rows of $\frac{3}{4}$-in. steam piping which runs lengthwise and crosswise along the bottom of wooden vat.

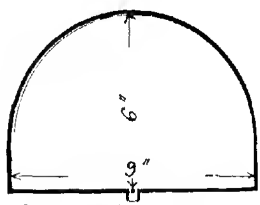


— CURD RACK —
CROSS SECTION



— CURD RACK LONGITUDINAL SECTION —

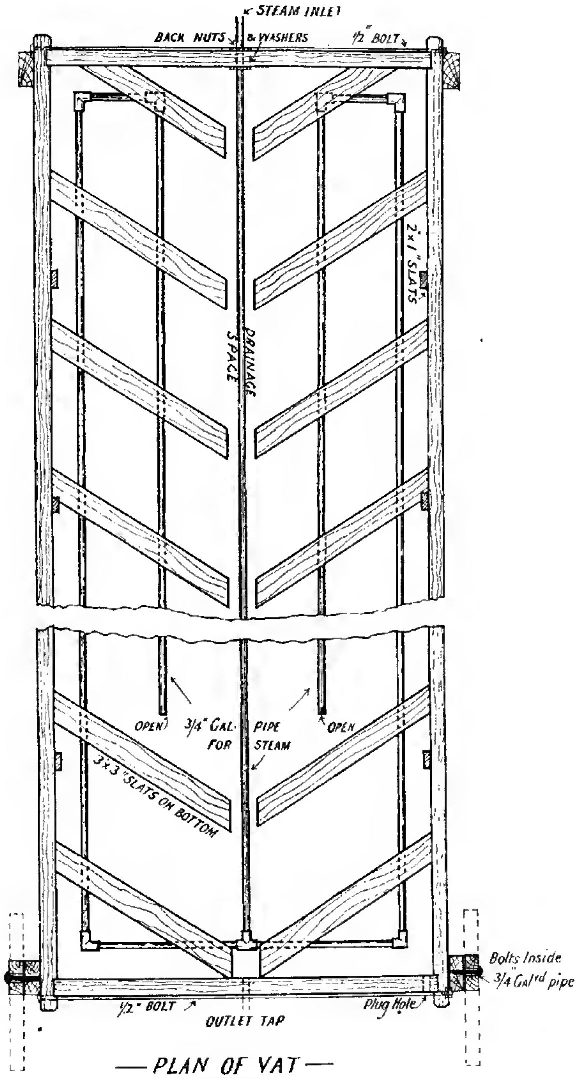




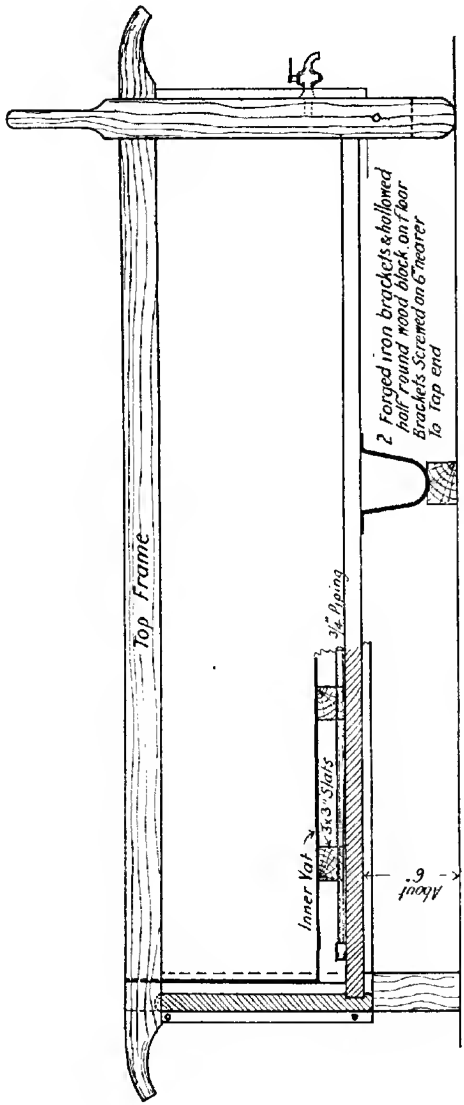
PLAN OF STRAINER

WHEY STRAINER Made With 20 Gge Perforated Tinned Steel with nozzle to fit inside tap

The slats are to be screwed down close on the bottom, 1 foot apart diagonally, from sides to middle, pointing towards the water outlet; the


STEAM INLET
BACK NUTS
& WASHERS
1/2" BOLT
2×1" SLATS
DRAINAGE SPACE
OPEN
3/4" GAL. PIPE FOR STEAM
OPEN
3×3" SLATS ON BOTTOM
Bolts Inside
3/4" Gal^rd pipe
1/2" BOLT
OUTLET TAP
Plug Hole

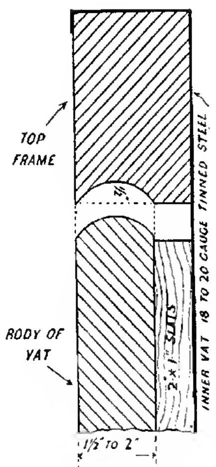
—PLAN OF VAT—



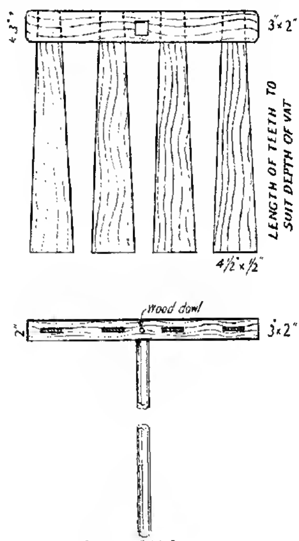
SECTION OF VAT

slats from either side not to approach nearer than from 2 to 3 inches from corresponding slat on other side, and leaving a drainage space down the middle of the vat from 2 to 3 inches, between end of slat.

At sides and ends slats are to be of 2 inches x 1 inch timber, attached perpendicularly to wooden sides, with ends 2 feet apart, fastened with screws, counter-sunk. A hole with brass screw flange from 1 to 3 inches in diameter, riveted and strongly soldered, flush with bottom, must be provided at the middle of the vat end, which can be lowered. The opening should be placed low enough to drain out the last of the whey when tilted. A corresponding hole must be made in the wooden vat also, through which the threaded tap from the inner vat will pass.



— SECTION —



— CURD RAKE —

Bore one 1-in. hole in each end of body, one 2 inches from top edge, for water inlet, and the other close to bottom ledge, tap end, for water outlet, and insert 1-in. brass tap, and, in addition, another hole at the tap end, about 2 inches from top, for water overflow.

Underneath sides and ends of inner vat are to be given three coats of red lead paint.

Strainer to be made of 20-gauge perforated tinned steel, with nozzle, to fit inside of vat tap.

Curd racks are to be made with kauri, in 2 feet sections, to fit inside three-quarter length of inner vat. Supports 5 inches to 6 inches high, slats 1 inch x ½ inch, half round, and ⅜ inch apart.

Vat canvas cover, with 2 inches x 1 inch kauri laths, 12 inches apart, to fit the vat crosswise.

WATER SUPPLY FOR COWS AND DAIRIES.

By E. W. Murphy, Dairy Supervisor.

The necessity of a liberal supply of good clean drinking water for milch cows needs great emphasis, for too often we find that the only water available is that from a dam or waterhole into which the cattle have access so that they puddle it up and pollute it. In many parts of the State the supply of water for stock is dependent upon surface catchment into dams or waterholes, or upon subterranean sources. In the Upper Murray districts I found many farms supplied with beautiful water from quickly flowing streams, and frequently it was brought in open trenches right past the dairy and yards, and at one place in the Mitta Valley the separator was driven by a water wheel. Here on the Western plains and in the Wimmera districts, waterholes on the surface at times become offensive bogs, and cows being forced to drink at these objectionable places often develop digestive troubles. Water that has become polluted in such reservoirs can be cheaply purified by using chloride of iron, or lime, to precipitate the clay and organic matter. It will cost very little, and if a quantity of either agent in excess of that actually required to clarify the water be used, the stock will further benefit, as both chloride of iron and lime are essential in the animal economy. Full details of the method of using iron chloride, or lime, were given in an article by the late Dr. Rothera in the *Journal of Agriculture* of July, 1910.

The dam or waterhole should be fenced off and the water lifted into tanks, or gravitated into troughs if possible. Trees should be planted about the banks to give welcome shade to the cattle. It has been found in many cases that cows show a marked preference for well or spring water, even though the water from the surface catchment be fairly clean, and there is abundant evidence of good results following the use of water from underground. The freedom of such waters from deleterious organisms is probably an important factor always, and in some cases it may be the chief reason of the benefits experienced, but often it is the minerals contained in the water from below, which we should credit with the favorable influence on the health of the milking cows.

Agricultural and veterinary science are only now coming to be recognised in their true relationship to human welfare, and the researches at the experimental stations have borne fruit which will be of great value to the race, by throwing light on the causation of disease, and in return we may no doubt look to the physician for help towards a better understanding of the causes of disease in cattle. In the history of medicine we find that many wells were famed for the curative properties of their waters, and especially in connexion with the elimination of toxic matters from the system, and from the Agricultural Experiment Station of Ohio, U.S.A., comes the brightest light that science has shed on the subject of the service of minerals in the animal economy. Professor Forbes tells us that they are *essential* for maintaining the proper condition of the blood and for the structure of the cells throughout the system, as well as for the electrical efficiency of the body fluids.

Saline and mineral waters are mostly from volcanic strata, and the nature and amounts of the minerals held in solution will be governed by the kind of rocks and soils passed over, or percolated through, and

by the presence of gases such as oxygen and carbonic acid gas. Filtered and purified, and then laden with valuable salts, and charged with life-giving forces, water brings vitality to the cells, to enable them the better to resist the invasion of enemies, and to throw off noxious matter. The low content of essential minerals in many of our soils has led to the evolution of native grasses which suit the conditions as far as growth is concerned. The low percentage of mineral salts ordinarily found in the herbage of certain districts is aggravated in dry times by the lessened transpiration of water, because the amount of mineral in the leaves of grass *must* be according to the movement of water from the soil through the plant.

In view of the super-refinement of the flour, and the general use of tank water, milk as a food has a very special significance for the nutrition of the nerves and formation of teeth, and yet I find many persons, young and old, who have an aversion to it, and many housewives who make the serious mistake of stinting the milk supply. Dirty methods of milking, and the repeated use of dirty water to wash hands and udders are of some influence in this connexion, and the common sight in country towns of cows drinking from dirty gutters no doubt helps to turn folk against milk. Even if milk is absolutely sterile when drawn from the udder, such foul water may lead to its contamination after being drawn, owing to the soiling of the cow's body, whence organisms may reach the bucket, and, therefore, no milking cow should have access to gutters. The purity of the water used for washing up in the dairy is also important, and certain faults in cream and milk are due to organisms in the water that the utensils are rinsed with, and obviously, disease may be spread in the same way. As a matter of sentiment, from a business point of view, and in relation to the health of the community, a good water supply for cattle and for dairy use is an essential requirement.

FEEDING THE UNBORN PIG THROUGH LUCERNE.

The data contained in the following article, though necessarily requiring correction for climatic differences between this country and America, seems to us worthy of note, and it will be seen that the advocacy of lucerne (or alfalfa) in pig rearing, to which attention has so frequently been directed in these columns, is borne out by the results of actual experiment under carefully devised conditions in the United States:—

A feeding experiment in the winter of 1910 at the Iowa Station showed that when the brood sow received daily 3.65 lbs. of shelled corn, the new-born pigs averaged 1.74 lbs.; when fed 2.75 lbs. of shelled corn and 0.43 lbs. tankage, the new-born pigs weighed 2.23 lbs. each; and when fed 3.74 lbs. of shelled corn and 1.11 lbs. of alfalfa in a rack the average weight of the new-born pigs was 2.29 lbs. It is gratifying to know that the unborn pigs, fed corn and alfalfa through the dam, not only gain good size, but they were also strong, and were produced at a cost considerably less than those fed on corn alone. In an experiment

conducted the winter of 1913-14, with rations including corn, butter-milk, alfalfa, and meat meal, the following results were achieved:—

EFFECT OF RATIONS FED GILTS ON RESULTING LITTERS.

	Number in Litter.	Average Weight.
		lbs.
Corn only	5.6	2.12
Corn plus 200 p.c. butter-milk	9.8	2.23
Corn plus 140 p.c. ground alfalfa	9.6	2.19
Corn plus alfalfa in rack	7.6	2.13
Corn plus 10 p.c. meat meal	8.8	2.48

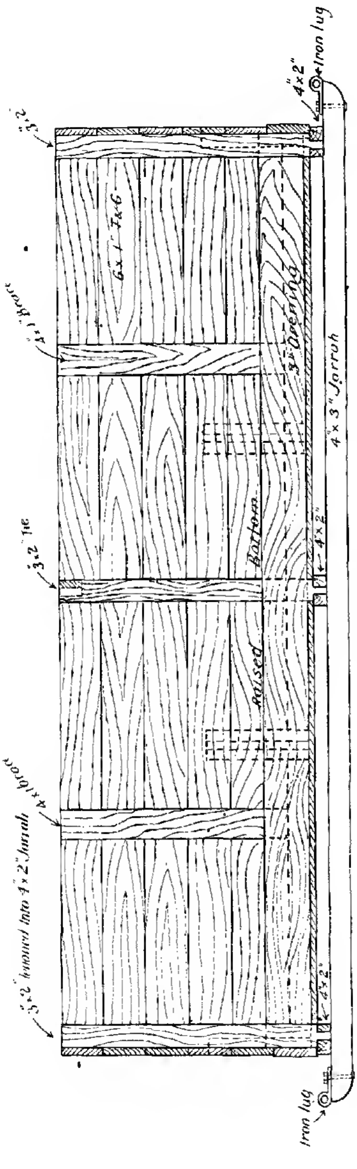
We here see the results of the previous experiment confirmed, and it well illustrates the desirability of some protein to supplement corn in feeding brood sows. Not only were the new-born pigs in greater number, but of better size and strength. The gilts receiving a supplement to corn made larger and cheaper daily gains, as is indicated in the following table:—

	Average Daily Gain.	Corn Grain.	Supplement.
	lbs.		lbs.
Corn only	.37	4.11	—
Corn and butter-milk	.51	2.84	5.83
Corn and ground alfalfa	.50	2.11	3.00
Corn and whole alfalfa	.50	3.94	.48
Corn and meat meal	.49	3.24	.33

The experimenters found difficulty in getting some sows to eat sufficient alfalfa out of the rack in order to insure the kind of litters hog men want. Hence, they tried the ground alfalfa as a supplement, and found it successful. One year the yearling sows farrowed weak "corn alone sort" of litters, because they simply ignored the alfalfa in the rack, good quality though it was. This word of caution may not be amiss: Be sure your gilts and old sows carrying litters eat at least a half-pound, better over a pound, of alfalfa daily; otherwise, if the deficiency is not remedied somehow, there'll be regrets expressed on farrowing day.

Corn, alfalfa, and meat meal tankage should make a very exceptionally good trio of brood sow feeds if happily combined. A suggestive ration which would be quite economical would be to give the sows, gilts, and older ones enough corn to keep them in good condition, adding alfalfa in a rack, and giving them about 1-5 to ¼ lb. of meat product daily. The alfalfa may be ground and mixed with corn, say, 100 lbs. corn to 100 lbs. alfalfa, and same allowed in a self-feeder. An average gilt of 250 lbs. will eat about 5 to 6 lbs. of this daily, so to get the necessary tankage into it, mix with every hundred about 5 lbs. of this meat product. If the sows get too fat, increase the proportion of ground alfalfa accordingly—the results should be happy ones at farrowing time. Don't forget the common salt at free will, and plenty of good wholesome water. Wood ashes are a most excellent swine feed, and prairie farmers are unfortunate in that they have so few of them. Cob ashes are good, and charred cobs are of exceptional value, because they furnish a form of charcoal that hogs relish, and do well with.

—*Hoard's Dairyman.*



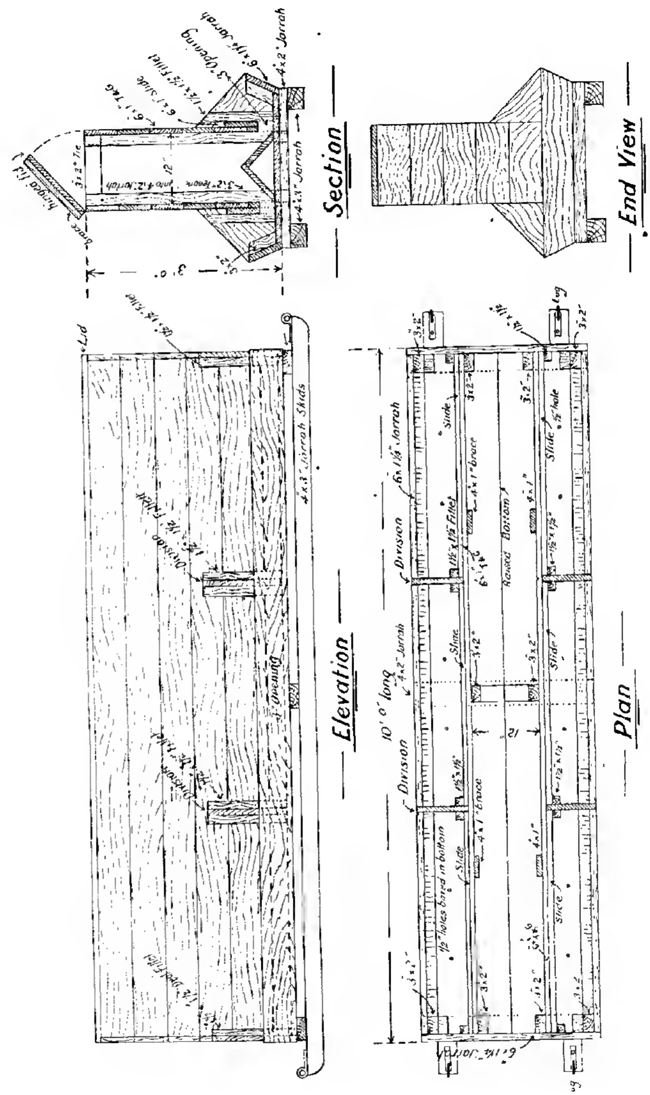
Longitudinal Section.

AUTOMATIC FEEDER.

By R. T. Archer, Senior Dairy Inspector.

Frequent inquiries are made regarding the construction of a self-feeder for use when the hand-feeding of sheep or other animals is necessary.

The plan illustrated on this and the next page may be modified to suit circumstances. The feeder may be made strong so that it will hold a weight of grain, but may be lightened somewhat and enlarged if only required for chaff. It will be noticed that along the bottom of each side there is a slide to raise or lower. This would be closed down for grain to prevent it running too freely, and opened for chaff. Being placed on skids a horse can be hooked on to the lugs and the hopper pulled on to clean fresh ground. By this means, also, the manure will be more evenly distributed over the land. The soft wood should be painted to protect it from the weather. Painting would not be necessary if hardwood were used, but the weight would be increased. The plan explains itself, and to make it according to design would cost about £5.


Section
End View
Elevation
Plan
10' 0" long
Raised Bottom
4 x 3" Jarrah Skids
Division
Slide
Lid

FERTILIZERS IN THE ORCHARD.

In a paper dealing with fertilizers in the orchard, read before a recent meeting of the Spencer Branch of the Agricultural Bureau of New South Wales, Mr. Reuben Daniel said that many farmers and orchardists fought shy of manuring, contending that it cost too much. For others it held a certain amount of mystery. With these contentions he did not agree. Fertilizers should be regarded as a means of supplying plant food, and if the increased returns were figured out it would be realized that it was cheaper to manure than to leave the land hungry. It was quite impossible to get full development of the soil's resources without thorough cultivation. A deficiency of plant food could not be made good by even the most perfect cultivation alone.

For practical purposes it might be said that the chief constituents of plant food were three in number—nitrogen, phosphoric acid, and potash. For this reason the principal manures were divided into three classes—(1) nitrogenous manures, containing chiefly nitrogen; (2) phosphatic manures, containing phosphoric acid; (3) those containing potash.

Nitrogen was very important because it entered largely into the composition of a fertile soil. Most plants derived nitrogen from the soil, although a few—such as lucerne, peas, beans, clover, &c.—got a large share from the atmosphere. It was a matter of determining the elements of plant food which required replenishing in the soil. Some manures, such as dried blood, sulphate of ammonia, nitrate of soda, and superphosphate were quickly dissolved in damp soil, and thus entered into action soon after application. For this reason they were best applied in the spring, while, on the other hand, bonedust, guano, and sulphate of potash took longer to dissolve; therefore it was advisable to apply them in the autumn, and they were then ready to be absorbed by the plants in spring, when the growth was faster.

Some orchardists used bonedust only, others blood and bone. This was a grave error. Bonedust contained no potash, which was a very important constituent of all fruits. Bonedust and blood and bone could supply nitrogen and phosphoric acid, but potash must be added if a good crop was to be assured.

Mr. H. J. Woodbury expressed the opinion that orange and mandarin trees growing in virgin soil required more potash than nitrogen, while lemons required more nitrogen. Apples, pears, and peaches required phosphoric acid and potash, and if the soil happened to be deficient in these properties, a heavy dressing would be needed. Cover crops of pears, and, in fact, of any of the legume family of plants, if ploughed in at the correct time, would supply the soil with nitrogen.

—*Fruit World of Australasia*—May, 1917.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Principal, Pomologist.

The Orchard.

As a preventive against codlin moth, apple and pear trees should be sprayed with arsenate of lead whenever there is danger from the prevalence of the moth. One of the secrets of success in codlin moth spraying is the destruction of as many as possible of the insects of the first brood. Thus, if particular care is given to the early sprayings, keeping the fruit covered with spray for a month or six weeks after setting, this result is easily accomplished. Some growers prefer to gather all fruit infected by the first brood, spraying only for the second and later broods. Even if all the fruits attacked are gathered, which very rarely happens, the grower suffers from the loss of fruit, which he can ill afford, unless his crop be a heavy one.

Another feature for consideration is the fact that the presence of any arsenical spray on the foliage is responsible for the destruction of the pear and cherry slug, root-borer beetle, and all forms of leaf-eating insects.

Spraying the cherries for the slug will now be necessary. Arsenate of lead may be used, provided the fruit is not far advanced. Hellebore, and also tobacco water, are effective against this pest.

Cultivation.

All orchard soils should be kept well worked during the summer months. It is very essential that the trees should have an abundant supply of moisture during the whole of the growing season. The rains that have fallen during the past months have given the subsoil a splendid soaking, which will benefit the trees considerably, and although the rain has very considerably interfered with the setting of the fruit crops, it will be very beneficial in the promotion of a vigorous growth to the trees. This will mean an increased supply of fruit buds for the next season, consequently the frequent summer cultivation of the soil will be a necessity if the health and vigour of the trees are to be maintained.

Excessive transpiration is often the cause of loss of young trees and of new grafts. They are found to part with a large amount of moisture, and are not able to obtain or retain sufficient for their nourishment; they then very soon wither and die. The soil around these should always be kept well stirred; they may also be given a good straw or grass mulching, and an occasional overhead sprinkling will greatly benefit them.

The planting out of citrus trees may be continued, sheltering the tender plants from winds with hessian or breaks of scrub.

The general aims in summer cultivation should be to maintain a good loose earth mulch during the whole season, and to keep down all weeds and useless orchard growths.

Pruning.

Summer pruning may now be commenced, particularly on apple, pear, and plum trees. The removal or reduction of surplus leader

growths, the shortening of unduly long laterals, and the thinning out of crowded shoots, will all tend to strengthen other parts of the tree and to increase the development of new fruit buds.

Vegetable Garden.

Tomatoes will require much attention at this time of the year. If the plants have been well looked after, they should be making vigorous growth. It will be to advantage to tie the plants to stakes, training them to two or three main growths, and pinching out all laterals as they come.

The plants should be well watered, and occasionally a handful of bonedust and blood manure mixed should be forked in around the roots. Where stable manure is used, it should be used as a mulch, forking it in every three or four weeks, and making a fresh mulch.

All plants of the cucumber and melon family should now be constantly supplied with ample water. Pinch out unnecessary lateral growths, and also the terminals.

The following seeds may now be sown:—French beans, cabbage and cauliflower for winter crops, parsnip, lettuce, and celery.

The side sheets of celery plants should be removed, afterwards earthing up the plants. Asparagus beds should be top-dressed, and allowed to grow without any more cutting. The vegetable beds will need frequent forking and hoeing to keep the soil sweet, and to keep down all weeds.

Flower Garden.

Plant out dahlias this month; tubers early, and plants grown from cuttings for exhibition blooms later in the month. Water well at planting, and keep well cultivated afterwards.

Rose bushes and beds may be given a good mulch with light stable manure, straw, grass, or lawn clippings. The beds should be kept rather dry, so as to allow the plants to rest before the autumn period of growth.

Sow seeds of cosmos, asters, zinnia, balsams, cockscomb, and other late summer and autumn blooming annuals.

Cut down delphiniums that have yielded their first crop of flowers, so as to allow a succession of flowers to come.

Daffodil, hyacinth, tulip, ranunculus, anemone, and other bulbs and tubers may be taken up and stored; while gladioli corms may still be planted.

The garden must be kept well watered and cultivated, so as to tide the plants over the hot and dry season.

REMINDERS FOR JANUARY.

LIVE STOCK.

Horses.—*Stabled.*—Over-stimulating and fattening foods should be restricted. Water should be allowed at frequent intervals. Rub down on coming into stables in an overheated condition. Supply a ration of greenstuff, where possible, to all horses. *Brood mares* should be well fed on succulent food if available; otherwise,

oats and bran should be given. *Foals* may with advantage be given oats to the extent of 1 lb. for each month of age daily. Provision should be made for shade shelter for paddocked horses.

CATTLE.—Provide succulent fodder and plenty of clean water and shade. Provide "lick" in trough, consisting of salt 20 lbs., bone meal 20 lbs., and sulphate of iron ½ lb. Limewash the cow bails it helps to keep down flies. Provide calves, if possible, with good grass run or lucerne hay or oats in a trough.

PIGS.—Supply short bedding in warm, well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. Sows suckling young should be well fed to enable them to produce plenty of milk. Give young pigs pollard and skim milk in separate trough as soon as they will take it, and keep them fattening from the start to get them off as early as possible. Give a tablespoonful of bone meal per 100 lbs. live weight in food daily. If pigs are lousy, dress with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect styes. Pig breeding and feeding should be very profitable for a long time to come, and it should be safe to launch out now. Plenty of water should be available for them to wallow in in hot weather.

SHEEP.—Ewes, after a season such as this, will come in season well to time. Merino and fine comebacks, November and December; crossbreds, January and February; pure British breeds, February and March. Be sure of ample rams running with them. Breed from every good ewe possible. Keep in view wool production as well as lamb and mutton. Meat and wool will be amongst the foremost commodities in demand for several years. Two-tooth ewes, if well grown, can be bred from, but they should be well treated throughout. Use rams with width and substance, and never inferior-fleeced ones. Rams work best at night and early morning. With large paddocks it may be necessary to yard occasionally in a season like this. Purgative drenches, worm pills, &c., should be given to all lambs, weaners, or grown sheep showing unhealthy discharge, for this is the chief attraction to the fly.

POULTRY.—Separate the sexes; the cockerels should now be fattened and marketed. Grade the young stock according to age and size, otherwise the younger birds will not thrive. Avoid overcrowding. Do not force pullets too much with animal food; build them up with a good variety of food, but avoid maize, and give but little meat. Increase the green food; thoroughly spray houses and perches with an emulsion of kerosene and soapsuds, or a solution of carbolic acid 1 in 60. Keep water vessels in shady spot, and renew water twice daily. Moisten dust bath.

CULTIVATION.

FARM.—Get all crops harvested and stacked as soon as possible. Horse hoe maize, potatoes and other summer crops. See to insurance of stacks of grain and hay.

ORCHARD.—Keep the soil well scarified and weed free. Cultivate after irrigation or rain. Do not allow the surface to become caked. Spray against codlin moth, pear slug, vine caterpillar, and woolly aphis. Summer prune strong growing shoots and laterals.

VEGETABLE GARDEN.—Plant out all seedlings, when ready, from former sowings. Stir and mulch the surface. Dig each plot as it becomes vacant. Sow seeds of cauliflower, cabbage, peas, French beans, Kohl Rabbi, &c.

FLOWER GARDEN.—Keep the soil moist and cool by watering, hoeing, and mulching. Stake tender and lengthy plants. Water and shade young plants. Sow pansy, Iceland poppy, cosmos, aster, &c.

VINEYARD.—Summer bud or *Yema* grafting may be practised in January, though February is the usual month. (See *Journals*, January and February, 1916.) This is the slackest month in un-irrigated vineyards—all ordinary work should be completed before Christmas. It is only exceptional operations, such as scarifying after rain, sulphuring in case of oidium, or spraying for downy mildew (see *Journal* for November, 1917), that must be carried out. In irrigated vineyards the application of water, and the cultivation it necessitates, require attention.

Cellar.—Fill up regularly and keep cellar as cool as possible. Towards end of month commence to make preparations for the coming vintage.